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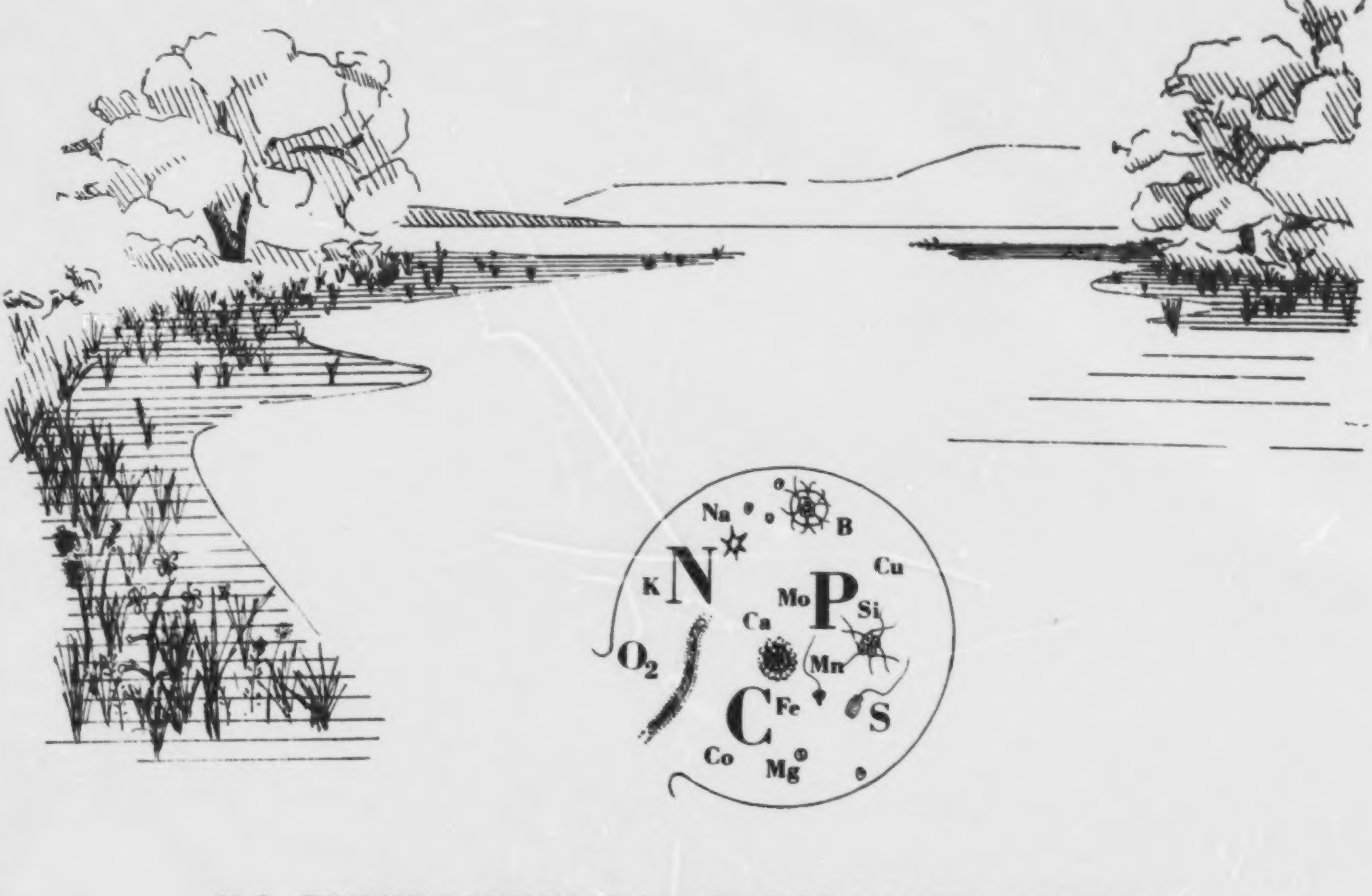

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16. Abstract

A survey of 452 eutrophic lakes was compiled based on responses from 40 states requesting information as to (a) Name, location, size, depth; (b) Description of the problem, including accounts of previous corrective treatments, if any; (c) Remedial action that might be appropriate; (d) A description of available background data, indicating whether sufficient data exists to document a change if rehabilitation were undertaken. The study comprises 340 lakes which are larger than 100 surface acres, 44 in the 51-100 acre size, and 68 smaller than 50 surface acres. The compilation represents lakes which have, in view of the respondents, deteriorated to the extent that rehabilitation is desirable. Categories of the problems in the survey were: nuisance algal growth, nuisance aquatic vegetation, fishkills, bacterial contamination, toxic contamination, oil brines, unstable water levels, siltation, excessive dissolved solids, and unspecified eutrophic conditions. Sources contributing to these problems were classified in two general categories--concentrated sources and diffused sources. Indication is given, where available, whether progress has been made to eliminate the pollution source or whether the source has already been eliminated. ~~(Auen-Wisconsin)~~
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PROBLEM LAKES
IN THE
UNITED STATES

by

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for the

Office of Research and Monitoring
ENVIRONMENTAL PROTECTION AGENCY

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INTRODUCTION

There is a growing concern in this country over the quality of America's lakes. As a result of this concern, considerable emphasis has been placed upon the development and implementation of large-scale management programs to define problems which exist, identify their causes, and prescribe corrective measures. Evidence of this movement is illustrated by Senate Bill 1017:[1]

> "the public fresh water lakes of the United States are irreplaceable resources for meeting many of man's public water supply, recreational, esthetic, industrial, agricultural, navigational, and other needs;
>
> "...many of America's lakes are suffering from man-made pollution caused by the continuing discharge of untreated or inadequately treated industrial and municipal wastes, from agricultural and urban runoff, including siltation due to soil erosion, and from manufactured products containing harmful pollutants discharged into municipal treatment systems which greatly accelerate the natural eutrophication resulting from the normal aging process of the lakes."

To properly attack the formidable problem of lake protection and renewal, a sound data base is required so that priorities may be established. At present, this is impossible because factual information on which to assess lake problems is, by and large, lacking. Some lakes, such as Lake Washington in Seattle and the lakes at Madison, Wisconsin, have been the subjects of extensive long-term studies. But, for the vast majority of lakes in the country, very limited data or none at all exist on which to base comprehensive management schemes.

At a minimum, information should be available to identify three general lake-quality categories:

1) Those lakes which are presently of high quality, and are not expected to degrade in the near future;

2) Those lakes which are presently of high quality, but are subject to degradation and will require protective

---

[1] Senate Bill S.1017, February 1971.

action if their condition is to be maintained; and,

3) Those lakes which have deteriorated to the extent that protective action is no longer sufficient and rehabilitation is required if satisfactory quality is to be re-established.

This report is an attempt to compile the information which is now available on lakes in the third category. It was made possible only through the cooperation of numerous individuals in a variety of agencies throughout the country. Their cooperation is sincerely appreciated. Forty states responded to our request for information. The resulting compilation includes 425 lakes. Of those, 340 are larger than 100 surface acres, 44 fall into the 51-100 acre range, and the remaining 68 lakes are smaller than 50 surface acres. In each case, it was left up to the individual respondents to determine what constituted a "lake which has deteriorated to the extent that rehabilitation would be desirable." The lakes are listed alphabetically by state, and the appendix includes the source of information for each lake.

The reader is cautioned to avoid drawing unwarranted conclusions from the information provided. The data do not represent a random sampling of lakes. For example, some states provided us with a rather lengthy list of lakes, whereas other states listed only a few or even none. To consider this number analogous to the extent of the problem in a particular state would be a misinterpretation of this report. There are areas where problem lakes most certainly exist, but where input for this report was lacking.

Nevertheless, this report represents the first effort of this type to identify severely degraded lakes. We plan to continue our effort and hope this activity will stimulate further action toward the much-needed management plan for our nation's lake resource.

DESCRIPTION OF STUDY

The information in this report was obtained in the following manner:

A general letter was prepared and sent to the Director of the Water Resources Institute in each state. This letter requested information concerning lakes in their state for which rehabilitation would be desirable. In particular, the following information was requested.

a. Name, location, size, depth;

b. Description of the problem, including accounts of previous corrective treatments, if any;

c. Remedial action that might be appropriate;

d. A description of available background data, indicating whether sufficient data exists to document a change if rehabilitation were undertaken.

The letters were followed by phone calls to answer questions which may have arisen and to explain more fully the objectives of our study. We also requested that copies of our letter be forwarded to others in the state who could provide additional information.

The information received in response to the survey was compiled and Interim Report #1 (First Draft), "Survey of Problem Lakes in the United States," was prepared. This report contained information from 30 states and listed data for 185 lakes. A copy of this draft report was sent to the director of each Water Resources Center and to all individuals who had supplied information. It was requested that they review the report and submit additional information if possible. This prompted the input of much additional information which is included in this revised report.

SUMMARY TABLE OF LAKES

The table which follows lists alphabetically, by state, each of the lakes included in the report. Each lake's surface area in acres, plus a categorization of its problem(s) and source(s) are given.

Problem categories included in the table are listed below:

NUISANCE ALGAL GROWTH
NUISANCE AQUATIC VEGETATION
FISHKILLS
BACTERIAL CONTAMINATION
TOXIC CONTAMINATION
OIL BRINES
UNSTABLE WATER LEVELS
SILTATION
EXCESSIVE DISSOLVED SOLIDS
UNSPECIFIED EUTROPHIC CONDITION[1]

The sources which contribute to these problems can be considered in two categories:

CONCENTRATED: Those point sources to the lake or a tributary stream which it would be possible to eliminate through treatment facilities.

DIFFUSED: Sources which are not localized and may be curtailed either through such measures as improved land use techniques or collection systems followed by treatment.

---

[1] Lakes which were described as eutrophic but the exact problem not specified, are included in this category.

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CONCENTRATED SOURCES listed in the table include:

MUNICIPAL EFFLUENTS
URBAN RUNOFF
INDUSTRIAL WASTES[1]
ANIMAL FEEDLOTS

DIFFUSED SOURCES include:

SEPTIC TANK SEEPAGE
RURAL RUNOFF
GROUND WATER
MARSH DRAINAGE

In some lakes, recycling of nutrients within the system may be a major contributor to the lake's problem. For example, rough fish action near the bottom of a lake or dredging operations may allow the release of nutrients bound up in the bottom sediments. However, this table only attempts to identify external sources which add to the nutrient budget of the lake.

In some cases, a source to the lake has been eliminated or progress made toward its elimination, for example, diversion of a municipal effluent away from the lake. In such instances the following subscripts have been used.

P	Progress has been made toward elimination of the source.
O	The source has been eliminated.

---

[1] Specific industrial sources are indicated in the table with the following symbols:

T	Thermal additions	M	Mine drainage

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
ARKANSAS																			
Chicot, Lake	3,000					X			X				X		X				
CALIFORNIA																			
Berryessa, Lake	20,736	X							X			X	X			X			
Clear Lake	43,840	X										X			X				
Goose Lake	124,160									X									
Salton Sea	225,280									X									
COLORADO																			
Cheraw Lake	650								X	X					X		X_p		
Granby Reservoir	7,700				X							X_p	X						
Grand Lake	1,000				X							X_p	X						
Shadow Mt. Res.	1,600				X							X_p	X						
CONNECTICUT																			
Bantam Lake	915	X	X									X							
Crescent Lake	50	X																	
Groton Pond	70	X	X																
Hitchcock Lakes	118		X																
Kenosia, Lake	70		X																

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
CONNECTICUT Con't																			
Lillinoah, Lake	1,900	X																	
Wonoscopomuc, Lk.	353	X	X																
Zoar, Lake	975	X																	
DELAWARE																			
Abbotts Pond	18		X																
Andrews Pond	21							X											
Becks Pond	22		X																
Betts Pond	60		X																
Blairs Pond	29	X						X				X							
Burton Pond	46		X					X											
Cedar Cr. Mill Pd.	57		X																
Chipmans Pond	47		X																
Clendaniel Pond	18		X					X											
Collins Pond	103		X																
Como, Lake	42	X						X				X							
Concord Pond	68		X																
Coursey Pond	75	X	X									X							

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
DELAWARE																			
Craigs Pond	12		X					X											
Cubbage Pond	41		X																
Derby Pond	20	X	X					X											
Diamond Pond	24		X					X				X							
Garrisons Lake	82		X					X											
Griffiths Lake	34							X											
Haven Lake	74							X											
Hearns Pond	66		X					X											
Horseys Pond	27		X												X				
Hudson Pond	18		X																
Ingrams Pond	29		X																
Killen Pond	65	X						X				X							
Lums Pond	209							X											
Marshalls Pond	13	X	X																
Masseys Mill Pond	30							X											
McCauley Pond	66	X						X											
McGinnis Pond	29							X				X							
Millsboro Pond	101											X							

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
DELAWARE Con't																			
Moores Lake	25	X						X				X							
Morris Mill Pond	44	X	X									X							
Noxontown Pond	159							X				X							
Portsville Pond	15		X																
Raccoon Pond	15		X					X											
Records Pond	90		X																
Red Mill Pond	179		X																
Reynolds Pond	38		X					X											
Shallcross Pond	43	X	X					X											
Silver Lk.(Dover)	157							X				X							
Silver Lk.(Midtn.)	38							X				X							
Silver Lk.(Milford)	27		X					X											
Smalleys Pond	19	X																	
Sunset Lake	43							X				X							
Trap Pond	84		X																
Trussum Pond	55		X																
Tub Mill Pond	7		X					X											
Voshell Pond	22	X	X					X											

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
DELAWARE Con't																			
Wagamons Pond	50		X					X				X							
Waples Pond	55							X	X										
Wiggins Mill Pond	21							X											
Williams Pond	84	X										X							
Wyoming Pond	47	X						X				X							
FLORIDA																			
Alice, Lake	91		X									X					T		
Alligator, Lake	77	X	X	X								X				X	X		
Apopka, Lake	34,146	X		X								X			X		X		
Beauclair, Lake	1,111	X		X	X				X								X		X
Bivens Arm	173										X				X	X			
Carlton, Lake	382	X		X	X				X				X		X	X			
Catherine, Lake	75			X													X p		
Clear Lake	11	X											X						
Conine, Lake	236	X			X							X				X	X		
Dexter, Lake	1,902	X			X				X										
Dicie, Lake	9	X											X			X			

LAKE NAME	SURFACE ACRES	PROBLEM: Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	SOURCE: Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
FLORIDA Con't																			
Dora, Lake	5,090	X		X								X				X			
Effie, Lake	102	X			X				X			X		X			X_p		
Eustis, Lake	6,771	X		X								X				X			
Francis, Lake	21	X		X		X			X							X			
Griffin, Lake	8,517										X	X					X		
Hancock, Lake	4,519	X			X			X	X			X			X		X		
Harris, Lake	17,519										X				X				
Hawthorn, Lake	87										X	X							
Hollingsworth, Lk.	356	X							X							X			
Inglis Reservoir	3,500		X																
Jessie, Lake	190	X		X	X				X			X			X				
Killarney, Lake	237	X	X													X			
Lawne, Lake	156	X		X	X							X			X				
Lochloosa, Lake	6,138	X													X				
Lulu, Lake	301	X		X	X				X			X				X	X		
Maggiore, Lake	388	X		X	X							X				X			
Maitland, Lake	451		X													X			
McLeod, Lake	512							X										X	

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
FLORIDA Con't																			
Munson, Lake	255	X		X	X				X			X			X				
Newman's Lake	6,331	X													X				
Okeechobee, Lake	448,000	X								X		X			X				X
Orange Lake	7,673	X	X									X			X				
Parker, Lake	2,272	X		X					X							X	T		
Rodman Reservoir	13,000		X						X								X		X
Rowell, Lake	364	X			X				X			X							
Scott, Lake	285	X		X											X				
Seminole, Lake	458	X			X							X				X		X	
Shipp, Lake	283	X		X	X				X			X				X	X		
South, Lake	1,101	X	X									X			X	X		X	
Talquin, Lake	8,580	X										X							
Thonotosassa, Lk.	819	X		X					X			X			X		X		
Tohopekaliga, Lk.	18,810	X							X			X			X	X	X	X	
Tracy, Lake	136		X	X													$^{T}X_{p}$		
Tsala Apopka, Lk.	19,111										X	X							
Underhill, Lake	147	X														X			
Virginia, Lake	223		X													X			

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
FLORIDA Con't																			
Wales, Lake	326		X													X			
Wauberg, Lake	255	X																	
GEORGIA																			
High Falls Lake	460	X		X	X														
Jackson, Lake	4,750	X	X									X							
ILLINOIS																			
Fox Chain of Lakes	6,400	X										X	X		X				
INDIANA																			
Big Chapman Lake	581		X																
Big Otter Lake	69	X	X																
Big Turkey Lake	450		X																
Bower Lake	25	X										X_p			X				X
Bruce Lake	245	X	X																
Cedar Lk. (Lake)	781	X			X								X						
Cedar Lk.(Whitley)	144		X																
Diamond Lake	79		X																

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
INDIANA Con't																			
George, Lake	270	X	X		X				X			X_p							
Golden Lake	119	X										X_p			X				X
Heaton Lake	87		X					X							X				
Henderson Lake	22	X		X	X							X_p				X			
Hogback Lake	146	X										X_p			X				X
Lake of the Woods	416		X												X				
Little Bower Lake	12	X										X_p			X				X
Little Otter Lake	34	X	X																
Long Lake	92	X										X_p			X				X
Lost Lake	43	X		X				X				X							
Palestine Lake	290		X												X				X
Round Lake	131		X																
Shriner Lake	120		X																
Silver Lake	102	X			X							X_p	X		X				
Sylvan Lake	630	X										X_p							
Syracuse Lake	414		X																
Town Lake	22	X		X								X_p	X						

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainaye
INDIANA Con't																			
Waubee Lake	187	X												X	X		X		X
West Otter Lake	118		X																
Winona Lake	526	X	X									X_p			X		X		
Yellow Creek Lake	150		X																
KANSAS																			
Cheney Reservoir										X									
LOUISIANA																			
Caddo Lake	32,640						X										X_p		
Calcasieu Lake	42,880					X									X		X		
Catahoula Lake	26,880						X										X_p		
Cocodrie Lake	19,456								X										
Cross Lake	8,832						X										X_p		
Fausse Point, Lake	15,360						X										X		
Ponchartrain, Lake	397,440				X											X			
Sabine Lake	55,680						X										X		
Salvadore, Lake	44,800						X										X		
Six Mile Lake	19,200								X										

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
LOUISIANA Con't																			
Verret, Lake	14,080					X											X		
MAINE																			
Annabessacook Lake	1,420	X	X									X					X		
Bauneg Beg Lake	160	X										X							
Bonny Eagle Lake	211	X																	
Cobbosseecontee Lk.	5,543	X	X									X					X		
Cochnewagon Pond	385	X	X									X			X				
Estes Lake	387	X	X									X_0					X		
Little Ossippe Lk.	564	X										X							
Lovejoy Pond	324	X	X												X				
Middle Range Pond	366	X										X							
North Pond	2,115	X										X							
Pattee Pond	712	X	X									X			X				
Pushaw Lake	5,056	X	X		X							X							
Sabattus Pond	1,787	X	X		X							X			X				
Schoodic Lake	389	X	X									X			X				
Sebasticook Lake	4,288	X	X									X_p					X_p		

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
MAINE Con't																			
Spaulding Pond	118	X	X									X					X		
Taylor Pond	625		X									X			X				
Three Mile Pond	1,077	X										X							
Togus Pond	648	X	X									X							
Toothacker Pond	30	X										X					X		
Webber Pond	1,252	X	X									X			X				
MARYLAND																			
Roland, Lake	80	X							X			X	X			X			
MASSACHUSETTS																			
Ashfield Lake	30		X										X						
Ashmere, Lake	184		X																
Bartlett Pond	45		X						X					X					
Billington Sea	270		X										X	X					
Buel, Lake	196		X										X						
Cochituate, Lake	591	X	X																
Flax Pond	40	X	X										X						

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
MASSACHUSETTS Con't																			
Flint Pond	90		X																
Forest Lake	55		X										X						
Hager Pond	30	X		X								X							
Jordan Pond	20		X																
Mystic Lk. (Upper)	200	X		X		X						X							
Mystic Lk. (Lower)	111										X								
Nutting Lake	67	X	X									Xp			X				
Pontoosuc Lake	505		X									X	X		X		X		
Quinsigamond, Lk.	1,051										X	X					X		
Reservoir Pond	225		X																
Sabbatia, Lake	250	X	X												X				
Sherman, Lake	86		X																
South Watuppa Pond	1,283	X									X								
Stiles Pond	60	X	X																
Studley Pond	26	X	X																
Watson Pond	94		X																

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
MICHIGAN																			
Barton Lake	347											X					X_P		
Bear Lake	415	X													X				
Betsie Lake	250											X_P					X		
Brighton Lake	500	X										X_O							
Chemung Lake	310		X										X						
Deer Lake	897	X										X							
First Lake	40	X										X_P							
Ford Lake	1,049	X										X_P	X						
Fremont Lake	790	X										X_P							
Hemlock Lake	4										X								
Jordan Lake	400	X										X_O							
Kent Lake	1,200	X										X_O							
Lansing, Lake	452		X		X				X			X_O							
Lobdell Lake	545		X												X				
Macatawa Lake	2,218	X										X_P					X		
Manistee Lake	930																X_P		
Mona Lake	695	X										X_P							

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
MICHIGAN Con't																			
Muskegon Lake	4,150	X	X				X					X_P					X_P		
Odessa, Lake	430										X								
Ore Lake	220	X										X_P							
Randall Lake	220	X	X									X_P							
Section-4 Lake	3										X								
Sixth Lakes (#6)	34	X										X							
White Lake	2,571	X	X									X_P					X_P		
MINNESOTA																			
Amber Lake	179	X										X_O	X_O						
Big Stone Lake	12,400	X	X									X	X	X	X		X	X	
Briggs Lake	406	X																	
Budd Lake	179	X										X_O	X_O						
Buffalo Lake	1,510	X										X							
Cotton Lake	1,916		X																
Demontroville Lk.	156	X						X											
Detroit Lake	3,089	X	X									X							
Francis Lake	318	X	X																

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
MINNESOTA Con't																			
George Lake	82	X										X_0	X_0						
Hall Lake	552	X										X_0	X_0						
Jefferson Lake	2,290	X																	
Julia Lake	137	X																	
Long Lk. (Isanti)	376	X																	
Long Lk. (St.Louis)	157												X				M		
Madison Lake	1,345	X						X											
Minnetonka Lake	14,310	X	X													X			
Melissa, Lake	1,827	X	X									X							
Pike Lake	508	X						X											
Prior Lake	620	X											X						
Rice Lake	433	X	X					X											
Rush Lake	161	X																	
Sakatah Lake	881	X										X			X				
Sallie, Lake	1,287	X	X									X							
Shagawa Lake	2,639	X										X							
Shetek Lake	3,596	X						X	X										

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
MINNESOTA Con't																			
Sisseton Lake	139	X										X_0	X_0						
Spring Lake	690	X						X											
Tetonka Lake	1,336	X													X				
MISSOURI																			
Jacomo, Lake	970	X											X	X	X				
MONTANA																			
Georgetown Lake			X	X															
NEBRASKA																			
Salt Valley Res's.																			
Branched Oak	1,800	X	X												X				
Pawnee	740	X	X												X				
Stagecoach	170	X	X												X				
NEW HAMPSHIRE																			
Kezar Lake	180	X										X							
Winnisquam Lake	4,300	X										X							

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
NEW JERSEY																			
Allentown Pond			X																
Atsion Lake	93		X																
Budd Lake	376		X																
Carnegie	237		X						X										
Collier's Mill Pd.	17		X																
Como Lake	34		X																
Deal Lake	158		X						X										
Duhernal Lake	93		X																
Greenwood Lake	983		X																
Grovers Mill Pond	28		X						X										
Hopatcong, Lake	2,685		X																
Imlaystown Lake	28		X						X										
Musconetcong, Lk.	300		X																
Newton Lake	198								X										
Parsippany, Lake	160	X																	
Paulinskill Lake	157	X																	
Peddie Lake			X						X										

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
NEW JERSEY Con't																			
Pompton Lakes	204		X						X										
Rowands Pond	2		X					X											
Saxton Lake	60		X																
Shepherds Lake	72		X																
Solitude, Lake	19		X						X										
Speedwell Lake									X										
Square Circle Lk.				X		X													
Sunset Lk.(Asbury)											X								
Sunset Lk.(Brdgtn)	179	X																	
Takanasee Lakes			X																
Topenemus Lake	15		X																
Verona Park Lake	13										X								
Waterloo Pond	48		X																
Weequahic Park Lk.	80			X															
Westons Mill Pond	92		X																

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
NEW YORK																			
Cayuga Lake	42,496	X	X									X							
Conesus Lake	3,328	X	X									X	X				X		
George, Lake	28,200	X																	
Greenwood, Lake	1,920	X	X						X			X	X						
Oneida Lake	51,200	X		X								X_p							
Onondaga Lake	2,890										X	X					X		
Owasco Lake	6,592	X																	
Saratoga Lake	4,339	X		X								X_p	X						
Schroon Lake	4,230	X										X_p							
Seneca Lake	43,328		X																
NORTH DAKOTA																			
Ashtabula, Lake	890	X	X									X		X	X				
Jamestown Res.		X	X												X				
Spiritwood Lake	704	X																	

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
OHIO																			
Alma, Lake	73																M		
Buckeye Lake	3,800								X										
Deer Creek Res.	313								X										
Holiday Lake	208	X	X				X					X	X						
Hope, Lake	120																M		
Indian Lake	5,800								X										
Jackson Lake	242		X														M		
Loramie, Lake	1,500								X										
Oxbow Lake	36		X						X										
Portage Lakes	1,651								X										
St. Marys, Lake	11,000								X										
OKLAHOMA																			
Boomer Lake	255	X			X								X p			X	T		
Carl Blackwell, Lk.	2,700	X											X		X				
Foss Reservoir	8,800									X									
Grand Lake	59,000										X	X	X	X			X		

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
OREGON																			
Devils Lake	685	X	X		X								X						
Odell Lake	3,600	X											X						
Upper Klamath Lk.	98,560	X																	
PENNSYLVANIA																			
Black Moshannon Lk	250		X										X						
Conewago Lake	340	X	X										X		X				
Conneaut, Lake	928		X									X_P	X_O						
Edinboro Lake	247	X	X						X			X			X				
Frances Slocum Lk.	165		X										X		X	X			
Gouldsboro Lake	255		X										X				X		
Harvey, Lake	658			X	X							X							
Hills Creek Lake	137	X	X										X		X	X			
Jean, Lake	254		X										X				X		
Marburg, Lake	1,275		X																
Promised Land Lks.	595		X										X						
Pymatuning Res.	16,420		X										X		X	X	X		
Shenango Reservoir	3,560																		X

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
PENNSYLVANIA Con't																			
Tobyhanna Lake	170		X										X						
SOUTH DAKOTA																			
Andes, Lake	4,000																		
Big Stone Lake	21,120																		
Byron, Lake	1,300																		
Hendricks, Lake	1,600																		
Herman, Lake	1,350																		
Madison, Lake	3,000																		
Kampeska, Lake	3,000								X				X	X					
Mitchell, Lake	670												X		X				
Poinsett, Lake	8,000												X	X	X				
Twin Lake	1,500														X				
UTAH																			
Bear Lake												X	X	X	X				
Great Salt Lake					X							X							
Hyrum Reservoir		X										X		X	X				

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
UTAH Con't																			
Utah Lake		X								X		X		X	X	X	X		
VERMONT																			
Champlain, Lake	273,280	X		X	X	X						X_p					X_p		
Dunmore, Lake	1,035										X		X						
Memphremegog, Lk.	24,237										X	X							
VIRGINIA																			
Charlottesville R.	103	X		X															
Chickahominy Lk.	1,500										X	X_p							
Occoquan Reservoir	1,600	X										X							
Pounds Reservoir	154																M		
Smith Mountain R.		X		X								X				X			
WASHINGTON																			
American Lake	1,125	X																	
Badger Lake	244	X																	
Bay Lake	129	X		X															
Cranberry Lake	27	X																	

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
WASHINGTON Con't																			
Pass Lake	99	X																	
Campbell Lake	410	X																	
Green Lake	255	X																	
Island Lake	109	X											X						
Long Lk. (Kitsap)	314	X																	
Long Lk. (Spokane)	5,020										X	X					X		
Medical Lake	149	X																	
Moses Lake	6,815	X																	
Newman Lake	1,190	X	X								X		X						
Pine Lake	88										X		X						
Rock Lake	2,147	X																	
Sammamish, Lake	4,997										X	X_0					X_0		
Spanaway Lake	267	X																	
Steilacoom Lake	313	X																	
Vancouver Lake	2,858																		
Washington, Lake												X_0	X_0			X_0			

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
WASHINGTON Con't																			
Whatcom Lake	5,003									X			X_p						
Williams Lake	319	X																	
WISCONSIN																			
Big Butternut Lk.	378	X	X										X		X			X	
Big Muskego Lake	2,260	X		X				X				X							
Browns Lake	396		X					X				X							
Butternut Lake	830										X				X	X		X	
Delavan, Lake	2,072	X	X		X							X	X		X			X	
Eagle Lake	520	X	X	X				X				X							
Halfmoon Lake	132	X													X				
Horseshoe Lake	22	X	X										X				X_0		
Koshkonong, Lake	10,480	X		X															
Lilly Lake	87		X	X				X											
Little Muskego Lk.	506	X	X									X							
Long Lake (Polk)	257	X	X												X			X	
Long Lk. (Racine)	124		X	X				X					X	X					

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
WISCONSIN Con't																			
Lower Phantom Lk.	433	X	X																
Madison Lakes																			
Kegonsa	2,716	X	X									X_0			X	X			
Mendota	9,730	X	X									X_0			X	X			
Monona	3,335	X	X									X_0			X	X	T		
Waubesa	2,113	X	X									X_0			X	X			
Metonga, Lake	2,157	X											X						
Nagawicka, Lake	957	X	X		X							X			X	X			
Pell Lake	86			X				X											
Pewaukee Lake	2,493	X	X										X		X	X		X	
Pickerel Lake	52	X													X			X	
Redstone, Lake	625	X	X										X		X				
Round Lake	203	X											X		X			X	
Shawano Lake	6,178	X	X										X					X	
Snake Lake	12	X	X	X								X_0				X			
Tichigan, Lake	891	X	X									X	X						
White Potato Lake	975		X	X															

LAKE NAME	SURFACE ACRES	PROBLEM										SOURCE							
		Nuisance Algal Growth	Nuisance Aquatic Veg.	Fishkills	Bacterial Contamination	Toxic Contamination	Oil Brines	Unstable Water Levels	Siltation	Excessive Solids	Unspec. Eutrophic Cond.	Municipal Effluents	Septic Tank(s)	Feed Lots	Rural Runoff	Urban Runoff	Industrial Wastes	Ground Water	Marsh Drainage
WISCONSIN Con't																			
Wind Lake	936	X										X							
Winnebago, Lake	137,708										X	X	X		X		X		
Wolf River Lakes																			
Poygan	14,102										X	X	X						
Butte des Morts	8,857										X	X	X						
Winneconne	4,507										X	X	X						

LAKE DESCRIPTIONS

The following section contains a description of each lake in the report including:

LAKE NAME

LOCATION
SIZE
DEPTH

PROBLEM AND SOURCE

REHABILITATION

BACKGROUND DATA

COMMENTS

In cases where information was lacking, items have been omitted from the description.

In some states, instead of specific lakes being listed as problem lakes, the general condition of the lakes is given in the form of a statement by some individual in the state.

ALABAMA

No specific Alabama lakes are included. Correspondence with the Mobile District of the Army Corps of Engineers and the Alabama Power Company revealed that no reservoirs under their jurisdiction were impaired due to water quality degradation.

ARIZONA

The following statement from A. Richard Kassander, Jr., Director of the Arizona Water Resources Research Institute summarizes the feelings of Water Resource personnel in the state:

"Arizona does not have any lakes which can be considered to have serious impairment as a result of deterioration of water quality."

ARKANSAS

LAKE CHICOT

Location:	Chicot County, southeastern Arkansas
Size:	3,000 acres
Depth:	33 feet (max.) 16 feet (average)
Problem and Source:	Siltation and turbidity are the major problems in this lake and result from agricultural runoff. Insecticides also enter through runoff from cultivated land. There are no municipal discharges to the lake, but seepage from septic tanks probably occurs.
Rehabilitation:	Two large drainage canals entering the lake should be diverted into a sump area during flood flow for pumping into the Mississippi River (no diversion is required during normal flow).
Background Data:	Background data include pictures of turbidity, population samples, bottom organism data, and depth soundings.
Comments:	Projected water uses are recreational; boating, fishing, swimming. There is practically no current fish population.

CALIFORNIA

LAKE BERRYESSA

Location: T8N, R3W, to T9N, R4W
Size: 20,736 acres
Depth: 270 feet (max.)

Problem and Source: This is a relatively new reservoir with extensive recreational development along the shoreline. Problems in the lake are attributed to improperly functioning septic tanks, general increase in sediment production associated with large scale development, nutrients from surface runoff of golf courses and gardens. In addition, a high evaporation rate tends to concentrate nutrients which stimulate growth of a nuisance algae population.

Rehabilitation: A collection system for sewage is recommended with possible exportation outside the basin.

Background Data: Background data is available in "Hydrologic Data Bulletin 130," Department of Water Resources, Appendix D, Vol. 2 (1963 et seq.).

CLEAR LAKE

Location: T15N, R10W, to T13N, R7W
Size: 43,840 acres
Depth: 50 feet (max.)

Problem and Source: Large algal blooms have occured in the lake for at least the last forty years. Inflow of nutrients is from natural and agricultural sources (possibly community wastes as well). Presence of gnats severely restricts the recreational value of the lake. There is little flushing action in the lake, demonstrated by the fact that pesticides applied for gnat control in 1955 are still cycling in the lake.

Rehabilitation: Algal harvesting or growth inhibitors could be tried. Flow augmentation is probably the most viable alternative.

Background Data: Background data is available in "Evaluation of Water Pollution Potential, Clear Lake Basin 1956-66, "Sacramento State College Foundation (L. W. Horn, Principal Investigator) and "A Nutrient Budget Study," U.S.G.S. (in preparation, 9/70).

GOOSE LAKE

Location: T45N, R13E, to T49N, R13E
Size: 124,160 acres
Depth: 24 feet (max.)

Problem and Source: Lake is essentially a sink which serves to increase the salt balance; solids, too, are increasing in the lake. The lake does maintain a fishery and serves other recreational purposes possibly because of flushing which occurs during major floods.

Rehabilitation: Flow augmentation is the only suggested treatment.

Background Data: Background data is available in "Goose Lake Water Quality Control Policy Basic Data Report,"July 1966, Calif. R.W.Q.C.B., Central Valley Region.

SALTON SEA

Location: T7S, R9E, to T12S, R13E
Size: 225,280 acres
Depth: 45 feet (max.)

Problem and Source: Sea appears to have reached a state of equilibrium between inflow and evaporation resulting in continual buildup of solids; it is the natural sink for a large drainage area indicating that the problem with solids will continue; the Sea is already highly eutrophic.

Rehabilitation: The recommendation should be creation of a salt balance by salt export. Most plans seem to depend on pumping the more saline waters into evaporation ponds (Pomeroy), into geothermal recharge wells (Rex), or even exchange with the Gulf waters. Salinity gradients, increasing with depth, may be found, but with such a large shallow wind-swept body of water, there is question as to how dependable they would be.

Background Data: The Salton Sea, with an elevation of around 230 feet below sea level, is a natural sink for its drainage area. During the 1930's salinity was too high to support a fish population. However, completion of the Boulder Canyon Project provided sufficient augmentation and dilution to leave the sea with considerably fresher water. After World War II it was stocked with fish with the expectation that a suitable environment could persist for at least twenty years, which has been the case.

The present Salton Sea has been in existence for only about 65 years, but underlying salt deposits indicate that many lakes have occupied the site from time to time during recent geologic periods, depending on the direction of flow in the Colorado River. These ancient lakes underwent complete evaporation leaving layered salt deposits which are separated by sediments laid down when new flows of water entered the basin. Recent development of large storage facilities on the Colorado River, are expected to prevent the reoccurence of the natural phenomenon which has created these lakes.

Background data is available in "A Reconnaisance Study and Preliminary Report on a Water Quality Control Plan for Salton Sea," Dec., 1965, Pomeroy, Johnson, and Bailey.

COLORADO

CHERAW LAKE

Location: T22S, R54 and 55W
Size: 650 acres
Depth: 45 feet (max.)

Problem and Source: The lake occupies a natural topographic low. Irrigation ditches were constructed approximately fifty years ago to divert and collect irrigation return flow in the low area. During the past several decades evaporation from the lake has increased the salinity of the water. In addition, waste effluent from a turkey processing plant has added to the problem.

Rehabilitation: The turkey plant is on an abatement schedule which will result in secondary treatment of their effluent.Diversion of irrigation return flow would help alleviate problems associated with high salinity. However, such diversion would seriously degrade the Arkansas River below Cheraw Lake and may not be advisable for that reason.

GRANBY RESERVOIR

Location: T2N and T3N, R7S and R6W
Size: 7,700 acres (approx.)
Depth: 212 feet (max. at max. reservoir elevation)

GRAND LAKE

Location: T3N, R75W
Size: 1,000 acres (approx.)
Depth: 11 feet (max. at max. reservoir elevation)

SHADOW MOUNTAIN RESERVOIR

Location: T3N, R75 and 76W
Size: 1,600 acres (approx.)
Depth: 11 feet (max. at max. reservoir elevation)

Problem and Source: Problem has centered around inadequate waste treatment facilities, both a municipal plant and a number of individual septic tank systems. Immediate concern is over rising coliform levels and low dissolved oxygen concentrations.

Rehabilitation: Abatement dates have been established, and where necessary, cease and desist orders are being issued. Many of the individual systems have been corrected. A sanitation district has been formed which will collect the sewage from the west shore of Shadow Mountain Reservoir which will feed into a proposed new treatment facility. The community of Grand Lake has recently expanded its waste treatment facility to bring it into compliance with state standards. As of Feb. 1, 1971 secondary treatment with disinfection is being provided.

Background Data: Studies of these three lakes have been made by the Colorado Department of Health and the Federal Water Quality Administration. Background data has been collected by the state since July, 1968.

CONNECTICUT

BANTAM LAKE

Location: Towns of Litchfield & Morris (northwest Connecticut)
Size: 915 acres
Depth: 25 feet (max.) 14.4 feet (mean)

Problem and Source: The lake has had frequent algal blooms for several years. Rooted aquatic weeds extend out to the 2-meter contour covering approximately 25% of the lake area.

Effluent from the Town of Litchfield sewage treatment plant (serving 2,500 people) discharges into groundwater near lake inlet. The upper centimeter of sediments in this area contains at least 10 times the estimated annual input of N and P.

Rehabilitation: The lake has been treated at least once a year for about 6 years with copper sulfate with good results.

The White Memorial Foundation has submitted a formal research proposal to the Connecticut Research Commission requesting joint state and federal financing through the FWQA. The proposal is to study the effect of artificial destratification by aeration.

Background Data: The Commission has studied the lake in detail for several years and has data on file concerning the chemistry, temperatures and biological activity of the water and analyses of the bottom muds and inlet streams. The data indicate that eutrophic conditions are naturally produced.

Comments: Watershed covers 21,000 acres , 50% is forested, remainder is mixed tillage, pasture and abandoned fields.

CRESCENT LAKE

Location: Town of Enfield
Size: 50 acres
Depth: 6 feet (average)

Problem and Source: Lake experiences excessive algal growth.

Rehabilitation: The lake has been treated for the last few years with copper sulfate for algae (dosage rate too low for effective control). Weedone LV4 Butoxrethyl dichlorphenoxy acetate was used for the control of water lilies with reported success.

Background Data: Some biological data is available for the last 2-3 years.

GROTON POND

Location: Town of East Lyme
Size: 70 acres
Depth: 15 feet (approx.)

Problem and Source: There is quite a dense population of algae and weeds at this lake causing concern to property owners.

Rehabilitation: No reported treatment has been undertaken or proposed for the lake.

Background Data: Dam is owned by State Board of Fisheries and Game. There appears to be a conflict of interest between fish management and purely aesthetic considerations.

HITCHCOCK LAKES

Location: Town of Wolcott
Size: 118.4 acres
Depth: 10 feet (max.)   6.2 (average)

Problem and Source: Extensive weed growth (*Vallisneria*) over virtually the entire lake impairs boating and swimming.

Rehabilitation:	Some small test plots have been treated chemically but the results are not known at this time.
Background Data:	There is some biological data available back to 1959.

LAKE KENOSIA

Location:	Town of Danbury	
Size:	70 acres	
Depth:	10 feet (max.)	3.5 feet (average)

Problem and Source:	There is a water weed problem at the lake which has caused much concern since the property owners consider it a hazard to swimming and boating.
Rehabilitation:	Attempts to control water weeds (method unknown) were apparently unsuccessful. A consultant recommended raking in swimming areas.
Background Data:	Not much data is available.

LAKE LILLINOAH

Location:		
Size:	1,900 acres	
Depth:	100 feet (max.)	25 feet (average)

Problem and Source:	There are six towns bordering the lake; Newton, Southbury, Bridgewater, Brookfield, New Milford, and Roxbury. The algae bloom is as severe, if not more so, than at Lake Zoar, but because of very limited development on the lake, there is not as great public concern.
Comments:	Formed by a dam on the Housatonic River immediately above Lake Zoar.

LAKE WONOSCOPOMUC

Location: Salisbury
Size: 353 acres
Depth: 108 feet (max.)   36 feet (average)

Problem and Source: This lake is on the edge of advanced eutrophication.

Rehabilitation: Lake might be of interest as a general research or demonstration project.

LAKE ZOAR

Location:
Size: 975 acres
Depth: 75 feet (max.)   24.6 feet (average)

Problem and Source: There are four towns bordering the lake: Newton, Oxford, Southbury, and Monroe. This lake has had a history of severe algae blooms since 1947.

Rehabilitation: The lake has been treated yearly (except last year) since 1966 with one or two applications of copper sulfate, with good, if temporary, results. This method appears to be the most practical way of ridding the lake of algae for the forseeable future.

Background Data: The lake has been studied and documented very intensively since 1947. Continuing contracts with an expert aquatic biologist have not revealed any longe-range cures.

Comments: Formed by a dam on the Housatonic River with a drainage area of some 1500 square miles.

DELAWARE

Fifty-five freshwater impoundments were surveyed in 1966 by the Delaware Game and Fish Commission for identification of aquatic vegetation types and weed problems. Due to the similarities in problems and background data on these lakes, a general description of these categories which applies to all the lakes is given below. Following these descriptions, there is an individual listing of the lakes including information pertaining specifically to each lake.

Problem and Source: Both submerged and emerged vegetation are becoming more abundant in these lakes. Public fishing on some ponds is becoming more difficult due to this increased growth of vegetation. These conditions have led to undesirable changes in the kinds and sizes of fish caught.

Results of the investigation revealed that Spatterdock (Nuphar advena and N. variegatum) was the most abundant emergent species in Delaware's freshwater impoundments. The seeds of this plant are of fair food value to waterfowl; its leaves are eaten by muskrats and provide shelter for fish. When spatterdock occurs in an overabundance, however, other vegetation is crowded out. When this occurs, areas become undesirable for fishing and boating, and water movement is impeded resulting in increased deposits of silt.

Water lily (Nymphaea odorata) appears less abundant than spatterdock in most ponds but when it does grow in abundance, similar conditions exist. Floating heart (Nymphoides cordatum) and water shield (Brasenia schreberi) appear less frequently but do become problems to fishermen and boaters when overabundant.

Bladderwort (Utricularia sp.) is the most noxious submerged plant. It drifts freely and rises to choke surface waters. On the bottom of impoundments, bladderwort sometimes makes fishing very unsatisfactory. Water milfoil (Myriophyllum sp.), water weed (Anacharis canadensis), and coontail (Ceratophyllum demersum) follow bladderwort in causing undesirable conditions to exist in a few impoundments. Fanwort (Cabomba coroliniana) presents a problem only in Red Mill Pond.

Algae, mainly Pithophora sp., is very unsightly and creates undesirable fishing conditions in a few impoundments. When high temperatures, limited water flow and high nutrient levels combine to create optimum growth conditions, algae becomes a major problem.

In all of the impoundments studied, sedimentation has signigicantly decreased water depths since their origin. Portions of many of the ponds have now become marshy.

The impoundments on watersheds which receive effluents from food processing and sewage treatment plants generally have waters with periodic high plankton blooms and some algae problems. Those impoundments which do not receive that type of effluent have more luxuriant vegetation and more aquatic weed problems.

Rehabilitation: Water control structures in many of the impoundments are in need of repair or replacement to hold the original water level. The raising of water levels to a stable level would check many emergent weed problems. Properly applied chemical treatment prior to raising water levels would be desirable in some cases. Possibly, a previous winter draw-down of the impoundment would help to eliminate submerged water plants whose control is desirable.

Water should not be pumped from impoundments for irrigation or other purposes that would result in lowering the water level below the normal elevation of the spillway.

Recommendations are strongly urged for soil conservation practices to be conducted to slow down surface run-off. Cover crops, contour plowing and the preservation of woodlands throughout the watershed are recommended. Adequate sedimentation basins should be installed on all agricultural drainage systems before they enter the ponds.

The most desirable solution to increase water depths in the impoundments is to dredge the sediment. However, this is usually not yet feasible from the standpoint of what people are willing to pay.

Supervised chemical control for aquatic vegetation is advised when vegetation substantially decreases the potential fishing and boating within a pond or the vegetation renders the habitat unfavorable to desired fish populations. In no instance does the Game and Fish Commission recommend that all vegetation be eliminated from an impoundment. Only the immediate problem areas or specific plants should be treated.

Plankton is desirable for fish propagation by being important to the food chain. However, overproduction of plankton, particularly in combination with algae, reduces the enjoyment of fishing and allied recreation.

Background Data: All the included ponds were investigated as part of the 1966, aquatic vegetation survey by the Delaware Game and Fish Commission. The survey provided data on occurence and relative abundance of emergent and submergent vegetation types.

ABBOTTS POND

Location: Milford
Size: 18 acres
Depth:

Problem and Source:

Rehabilitation: Recommended action includes building of a new control structure, chemical control for submerged and emerged plants.

ANDREWS POND

Location: Felton
Size: 20.6 acres
Depth:

Problem and Source: Additional problems include water level and flow rate through pond.

Rehabilitation: Recommended action consists of curtailing irrigation from the pond.

BECKS POND

Location: Newark
Size: 22 acres
Depth:

Problem and Source:

Rehabilitation: Recommended action consists of chemical control for submerged plants.

BETTS POND

Location: Millsboro
Size: 59.5 acres
Depth:

Problem and Source:

Rehabilitation: Recommended action includes construction of a new control structure, and chemical control for emerged and submerged aquatic plants.

BLAIRS POND

Location: Milford
Size: 29.4 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water levels and flow rate through the pond.

Rehabilitation: Recommended action includes sewage treatment for wastes entering the lake, construction of a new control structure, and curtailment of irrigation from the pond.

BURTON POND

Location: Angola
Size: 45.5 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through the pond.

Rehabilitation: Recommended action includes maintaining a higher water level and chemical control for emerged plants.

CEDAR CREEK MILL POND

Location: Lincoln
Size: 57.0 acres
Depth:

Rehabilitation: No specific recommendations were made.

CHIPMANS POND

Location: Laurel
Size: 47 acres
Depth:

Rehabilitation: No specific recommendations were made.

CLENDANIEL POND

Location: Lincoln
Size: 18.4 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through pond.

Rehabilitation: Recommended action includes maintaining a higher water level and constructing a new control structure.

COLLINS POND

Location: Bridgeville
Size: 102.8 acres
Depth:

Rehabilitation: Recommended action consists of chemical control for emerged plants. The lake was recently restored to its normal water level with construction of a new control structure.

LAKE COMO

Location: Smyrna
Size: 41.7 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through lake.

Rehabilitation: Recommended action includes sewage treatment for wastes entering the lake, and curtailment of irrigation from the lake.

CONCORD POND

Location: Seaford
Size: 67.6 acres
Depth:

Rehabilitation: Recommended action consists of construction of a new control structure on the pond.

COURSEY POND

Location: Felton
Size: 74.8 acres
Depth:

Problem and Source: An additional problem is nutrient levels.

Rehabilitation: Recommended action consists of sewage treatment for wastes entering the lake.

CRAIGS POND

Location: Seaford
Size: 12.0 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through the lake. Recently constructed this pond still contains many stumps, logs, and trees.

Rehabilitation: Recommended action includes chemical control for submerged plants, and curtailment of irrigation from the pond.

CUBBAGE POND

Location: Lincoln
Size: 41.4 acres
Depth:

Rehabilitation: Recommended action consists of construction of a new control structure on the lake.

DERBY POND

Location: Woodside
Size: 19.8 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through lake.

Rehabilitation: Recommended action includes maintaining a higher water level, construction of a new control sturcture, and curtailment of irrigation from the pond. Weed control was practiced in November, 1966, using an experimental application of Casaron AQ.

DIAMOND POND

Location: Milton
Size: 24.2 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water levels, and rate of flow through the pond.

Rehabilitation: Recommendations include sewage treatment for wastes entering lake, construction of a new control structure, annual winter drawdown, and curtailment of irrigation from the pond.

GARRISONS LAKE

Location: Smyrna
Size: 81.5 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level and rate of flow through the lake.

Rehabilitation: Recommended action includes chemical control for emerged plants, and curtailment of irrigation from the lake. A new control sturcture was added recently raising the water level to a higher level than was previously maintained.

GRIFFITHS LAKE

Location: Milford
Size: 33.8 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through lake.

Rehabilitation: Recommended action consists of curtailment of irrigation from the lake.

HAVEN LAKE

Location: Milford
Size: 74.2 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through the lake.

Rehabilitation: Recommended action consists of curtailment of irrigation from the lake.

HEARNS POND

Location: Seaford
Size: 66.1 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through the pond.

Rehabilitation: Recommended action includes construction of a new control structure on the lake and curtailment of irrigation from the pond.

HORSEYS POND

Location: Laurel
Size: 27.2 acres
Depth:

Problem and Source: Recommended action consists of soil conservation practices to curtail surface runoff.

HUDSON POND

Location: Ellendale
Size: 18.4 acres
Depth:

Problem and Source: Recommended action includes chemical control for submerged and emerged plants. Chemical control has been applied in the past, more is required.

INGRAMS POND

Location: Millsboro
Size: 28.6 acres
Depth:

Problem and Source: A new control sturcture raised the water level in 1957.

KILLEN POND

Location: Felton
Size: 65.2 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through the pond. The pond has an extraordinary plankton bloom during the entire growing season.

Rehabilitation: Recommended action includes sewage treatment for wastes entering the lake, and construction of a new control structure.

LUMS POND

Location: Kirkwood
Size: 209.3 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through the pond.

Rehabilitation: Recommended action consists of construction of a new control structure on the pond.

Comments: This is the largest breakwater impoundment in the state and provides much recreation. Pond was formerly used as a settling basin.

MARSHALLS POND

Location: Milford
Size: 13.2 acres
Depth:

Rehabilitation: Recommended action consists of control for submerged plants.

MASSEYS MILL POND

Location: Cheswold
Size: 30.4 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through the pond.

Rehabilitation: Recommended action includes construction of a new control structure, and curtailment of irrigation from the pond.

McCAULEY POND

Location: Harrington
Size: 66.0 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through pond.

Rehabilitation: Recommended action consists of curtailment of irrigation from pond.

McGINNIS POND

Location: Canterbury
Size: 29.4 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through pond.

Rehabilitation: Recommended action includes sewage treatment for wastes entering the pond, construction of a new control structure, and curtailment of irrigation from the pond.

MILLSBORO POND

Location: Millsboro
Size: 101.4 acres
Depth:

Problem and Source: An additional problem is nutrient levels in the pond. A recently constructed water control structure raised the water level creating some shallow areas with stumps.

Rehabilitation: Recommended action consists of sewage treatment for wastes entering the pond.

MOORES LAKE

Location: Dover
Size: 24.5 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through the lake.

Rehabilitation: Recommended action includes installation of a sewage by-pass route, construction of a new control structure on the lake, and chemical control for algae.

MORRIS MILL POND

Location: Millsboro
Size: 44.1 acres
Depth:

Problem and Source: An additional problem consists of nutrient levels.

Rehabilitation: Recommended action includes sewage treatment for wastes entering the lake, and chemical control for submerged plants.

NOXONTOWN POND

Location: Middletown
Size: 158.6 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through the pond.

Rehabilitation: Recommended action includes the installation of a sewage by-pass route and curtailment of irrigation from the lake. The present control structure is new.

PORTSVILLE POND

Location: Portsville
Size: 15 acres
Depth:

Rehabilitation: Recommended action includes annual winter drawdown and chemical control for submerged plants. The control structure on the pond is relatively new.

RACCOON POND

Location: Laurel
Size: 15.4 acres
Depth:

Problem and Source: The pond is in need of deeper water. Half of the original pond is marsh with a navigable channel.

Rehabilitation: Recommended action includes maintaining a higher water level, construction of a new control structure, and chemical control for emerged and submerged plants.

RECORDS POND

Location: Laurel
Size: 90.2 acres
Depth:

Rehabilitation: Recommended action consists of chemical control for emerged plants.

RED MILL POND

Location: Nassau
Size: 178.5 acres
Depth:

Problem and Source: The pond is one of Delaware's largest freshwater impoundments, and is the only one in which fanwort is superabundant. It's lush growth in water less than five feet deep has left some coves inaccessible to fishing.

Rehabilitation: Recommended action consists of chemical control for emerged and submerged plants.

REYNOLDS POND

Location: Milton
Size: 38.2 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through pond.

Rehabilitation: Recommended action consists of construction of a new control structure on the pond.

SHALLCROSS POND

Location: Odessa
Size: 43.3 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through the pond.

Rehabilitation: Recommended action includes chemical control for algae, emerged and submerged plants and curtailment of irrigation from the pond. Chemical control of weeds has been practiced in the past whenever the need arose.

SILVER LAKE

Location: Dover
Size: 157.2
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through lake.

Rehabilitation: Recommended action includes installation of a sewage by-pass route and curtailment of irrigation from the lake.

SILVER LAKE

Location: Middletown
Size: 38.2 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through lake.

Rehabilitation: Recommended action includes sewage treatment or by-pass for wastes entering the lake and curtailment of irrigation from the lake.

SILVER LAKE

Location: Milford
Size: 27.2 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through lake. A poor water control structure leading to an old mill race results in low water levels.

Rehabilitation: Recommended action includes maintaining a higher water level, construction of a new control structure, chemical control for emerged plants, and curtailment of irrigation from the lake.

SMALLEYS POND

Location: Bear
Size: 18.7 acres
Depth:

Problem and Source: There is a periodic problem with blue-green algae in water intake pipes.

Rehabilitation: Recommended action consists of chemical control of emerged plants. Copper sulfate is applied when blue-green algae interferes in intake pipes.

Comments: This pond serves as a water reservoir for the Delaware Water Company. (4 million gallons are pumped daily.).

SUNSET LAKE

Location: Newark
Size: 42.6 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through lake.

Rehabilitation:	Recommended action includes installation of a sewage by-pass route and curtailment of irrigation from the lake.

TRAP POND

Location:	Laurel
Size:	83.7 acres
Depth:	
Rehabilitation:	Recommended action includes improvements to the present control structure and chemical control for emerged plants.

TRUSSUM POND

Location:	Laurel
Size:	55 acres
Depth:	
Comments:	This pond is the state's prize cyprus swamp and most picturesque impoundment.

TUBMILL POND

Location:	Milford
Size:	7 acres
Depth:	
Problem and Source:	Additional problems include water level and rate of flow through the pond.
Rehabilitation:	Recommended action includes maintaining a higher water level or dredging, plus chemical control of emerged plants.

VOSHELL POND

Location: Magnolia
Size: 22 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through the pond.

Rehabilitation: Recommended action includes maintaining a higher water level, construction of a new control structure, chemical control of submerged plants, and curtailment of irrigation from the pond.

WAGAMONS POND

Location: Milton
Size: 50 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through pond.

Rehabilitation: Recommended action includes sewage treatment for wastes entering the pond, construction of a new control structure, chemical control of emerged and submerged plants, and curtailment of irrigation from the pond.

WAPLES POND

Location: Milton
Size: 55.1 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through the pond.

Rehabilitation: Recommended action consists of construction of a new control structure on the pond.

WIGGINS MILL POND

Location: Middletown
Size: 21.2 acres
Depth:

Problem and Source: Additional problems include water level and rate of flow through pond.

Rehabilitation: Recommended action consists of curtailment of irrigation from the pond.

WILLIAMS POND

Location: Seaford
Size: 83.9 acres
Depth:

Problem and Source: The luxuriant growth and spread of green filamentou algae in the summer is a problem. The odor from its decay has been the source of numerous complaints by people living along the pond.

Rehabilitation: Recommended action includes sewage treatment for wastes entering the lake, and chemical control for algae.

WYOMING POND

Location: Wyoming
Size: 47.2 acres
Depth:

Problem and Source: Additional problems include nutrient levels, water level, and rate of flow through the pond.

Rehabilitation: Recommended action includes sewage treatment for wastes entering the lake, improvements on the present control structure, and chemical control for algae, and curtailment of irrigation, from the pond.

FLORIDA

LAKE ALICE

Location: Alachua County
Size: 91 acres
Depth: 7 feet (approximately)

Problem and Source: Lake is senescent and has been covered with water hyacinths in recent years. It receives the treated sewage from the University of Florida and cooling water from the University steam plant.

Background Data: Numerous studies have been conducted by the Florida Game and Fresh Water Fish Commission and the University of Florida, Engineering and Industrial Experiment Station. Data collection has been ongoing for at least the last three years and is particularly relevent to possible rehabilitation projects.

LAKE ALLIGATOR

Location: Pinellas County
Size: 77 acres
Depth: 5 feet (approximately)

Problem and Source: Lake is brackish and eutrophic. It receives urban runoff from the city of Clearwater, Florida, cannery wastes, and sewage effluent from Virginia Groves Estates sub-division.

Rehabilitation: Elodea was shaded out by dense growth of water hyacinths that were subsequently controlled with 2-4-D. Cattails, bullrushes and algal problems still persist.

Background Data: Data has been collected on an annual basis since 1966 and is on file at the Game and Freshwater Fish Commission's regional offices and the Fisheries Research Lab at Eustis, Florida.

LAKE APOPKA

Location: Oklawaha Basin, Orange County
Size: 34,146 acres
Depth: 15 feet (max.) 6 feet (average)

Problem and Source: The lake is hypereutrophic and experiences annual summer fishkills and noxious algal blooms. Agricultural runoff is implicated as a major contributor of nutrients (primarily from vegetable farms in reclaimed marsh and wetlands; also citrus groves, domestic wastes from towns and wastes from citrus concentrate processing plants).

Rehabilitation: A drawdown is planned for 1972. It is hoped that 80% of the bottom sediments will be oxidized. The project is being conducted by the Department of Air and Water Pollution Control and the Department of Natural Resources. Monitoring will be done by Florida Technical University at Orlando.

Background Data: The U.S. Geological Survey has sampled the lake periodically since 1959. The Florida Game and Freshwater Fish Commission has sampled the lake from 1960 to present. The State Board of Health published "Biological, Physical, and Chemical Study of Lake Apopka, 1962-1964" and "Summary Report of Lake Apopka," February, 1964.

LAKE BEAUCLAIR

Location: Oklawaha Basin, Lake County
Size: 1,111 acres
Depth: 13 feet (approx.)

Problem and Source: The lake is hypereutrophic, high organic color from Apopka. Beauclair Canal changes to heavy algal green as flow moves eastward across the lake. The fish population is unbalanced.

Rehabilitation:	A haul seine has been used to control rough fish in an effort to remove some of the nutrients which are being recycled in the lake. This method has been only partially successful in achieving the objective.
Background Data:	Data has been collected annually since 1966 by the Game and Freshwater Fish Commission. The lake has been monitored by the Orange and Lake County's Air and Water Pollution Control Boards with the intent of enforcing water quality standards.

BIVENS ARM

Location:	Alachua County
Size:	173 acres
Depth:	7 feet (approx.)

Problem and Source:	The lake is hypereutrophic. It receives urban runoff from part of Gainesville and agricultural runoff from the University of Florida experimental cattle farms.
Background Data:	See description for Lake Alice.

LAKE CARLTON

Location:	Oklawaha Basin, Orange County
Size:	382 acres
Depth:	17 feet (approx.)

Problem and Source:	Lake is hypereutrophic. One possible cause is an influx of nutrient enriched water from Lake Beauclair due to wind seiches and water management of Oklawaha stages. In addition, lawn fertilizers, septic tanks, and citrus groves may contribute.
Rehabilitation:	Copper sulfate was applied to the lake in 1965 with negligable results. Also, a haul seine has been operated for rough fish removal. Habitat manipulation research is currently in progress.

Background Data: See description for Lake Beauclair.

LAKE CATHERINE

Location: Lake County
Size: 75 acres
Depth: 14 feet (approx.)

Problem and Source: High B.O.D. from the B&W Citrus Plant has caused annual fish kills.

Rehabilitation: Problem has been partially alleviated.

Background Data: Surveys have been made by the Florida Game and Freshwater Fish Commission, Florida Department of Air and Water Pollution Control, and Lake County Air and Water Pollution Control Board.

CLEAR LAKE

Location: Alachua County
Size: 11 acres
Depth: 7 feet (approx.)

Problem and Source: Lake is eutrophic and experiences severe algal blooms. Also, there is a high organic color to the water.

Lake has become surrounded by homes with septic tanks which is probably one source of the problem which has developed in recent years.

Background Data: See description for Lake Alice.

LAKE CONINE

Location: Polk County
Size: 236 acres
Depth: 15 feet (approx.)

Problem and Source:	Lake is eutrophic. It receives residential drainage, wastes from three citrus processing plants and effluent from a 3.4 m.g.d. capacity sewage treatment plant recently built on the lake.
Background Data:	The Florida Game and Freshwater Fish Commission has studied chemical, physical, and biological parameters of the Winter Haven Chain of Lakes (1970).

LAKE DEXTER

Location:	St. Johns Basin, Volusia County
Size:	1,902 acres
Depth:	13 feet (approx.)

Problem and Source:	Lake is eutrophic. Edaphic conditions of St. Johns River watershed also affect other lakes in the St. Johns River Chain.
Background Data:	The Florida Game and Freshwater Fish Commission and the U.S. Geological Survey have made several surveys of the St. Johns River Basin.

LAKE DICIE

Location:	Lake County
Size:	9 acres
Depth:	15 feet (approx.)

Problem and Source:	Lake experiences windrowed yellow-brown algal blooms. Fifty percent of the homes in the lakes drainage area are served by septic tanks. In 1967, the Department of Transportation installed a large drain doubling the drainage area and adding extensive street drainage.
Rehabilitation:	Recommendations are in the planning stages but not firm.
Background Data:	The Florida Game and Freshwater Fish Commission and the U.S. Geological Survey have made surveys of the lake.

LAKE DORA

Location: Oklawaha Basin, Lake County
Size: 5,090 acres
Depth: 17 feet (approx.)

Problem and Source: Lake is hypereutrophic and experiences summer fish kills and algal blooms. It receives domestic sewage effluent and street drainage from the cities of Mt. Dora and Tavares.

Background Data: In recent 2-3 years, sampling of the Oklawaha Chain of Lakes has been done by the Orange and Lake Counties Air and Water Pollution Control Boards with the intent of enforcing water quality standards. The Game and Freshwater Fish Commission also has data collected on the lake.

LAKE EFFIE

Location: Polk County
Size: 102 acres
Depth: 6 feet (approx.)

Problem and Source: Lake is senescent. It receives sewage treatment plant and citrus processing plant effluents. Also, livestock and a solid waste disposal site are nearby, also contributing to the problem.

Rehabilitation: Florida Citrus Canners Corporation has installed a sprinkler cooler system on the lake for their wastewater in an effort to upgrade disposal.

Background Data: The Florida Game and Freshwater Fish Commission has analyzed the lake annually since 1965.

LAKE EUSTIS

Location: Oklawaha Basin, Lake County
Size: 6,771 acres
Depth: 16 feet (approx.)

Problem and Source: Lake is eutrophic and experiences summer fish kills and algal blooms. It receives the sewage effluent and street drainage from the town of Eustis, and also the outflow from Lake Dora upstream.

Background Data: The Orange and Lake Counties Air and Water Pollution Control Boards have sampled the lake for the past few years with the intent of enforcing water quality standards. The Game and Fish Commission has also collected some data on the lake.

In addition, the Federal Water Quality Administration laboratory in Athens, Ga., conducted a study of Lake Eustis in the summer of 1970.

LAKE FRANCIS

Location; Madison County
Size: 21 acres
Depth: 8 feet (approx.)

Problem and Source: Lake is hypereutrophic and has suffered numerous fish kills. Toxic elements are suspected in urban run-off combined with periodic oxygen depletions.

Rehabilitation: Described in 1962 as a "cold, crystal clear" lake, it has subsequently suffered alternating treatments of commercial fertilizer and herbicides to stimulate bloom and control aquatic vegetation.After having been thrown completely out of balance an "Aqua Air" system was installed to bubble air through the water column. Results are inconclusive, but seemed of some help.

Background Data: Intensive management has been carried out by the Game and Freshwater Fish Commission.

LAKE GRIFFIN

Location: Olkawaha Basin, Lake County
Size: 8,517 acres
Depth: 10 feet (approx.)

Problem and Source: Lake is eutrophic. It receives enriched water from upstream as well as effluents from the Leesburg sewage treatment plant and the Coca Cola Citrus Plant.

Background Data: See description for Lake Dora.

LAKE HANCOCK

Location: Polk County
Size: 4,519 acres
Depth: 5 feet (approx.)

Problem and Source: Lake is senescent. It has received domestic and industrial drainage from Lakeland and Auburndale areas for a long time. Also, an industrial phosphate effluent slime pond adjoins the lake.

Rehabilitation: The lake went dry temporarily in 1967 due to natural drought.

Background Data: The Florida Department of Air and Water Pollution Control surveyed a phosphate pollution accident in 1965 and the Florida Game and Freshwater Fish Commission has monitored the lake annually since 1966.

LAKE HARRIS

Location: Oklawaha Basin, Lake County
Size: 17,519 acres
Depth: 18 feet (approx.)

Problem and Source: The lake is moderately eutrophic. It receives drainage from muck farms and sand mines.

Background Data: See description for Lake Dora. Also, the Federal Water Quality Administration laboratory in Athens, Ga., conducted a study on Lake Harris in the summer of 1970.

HAWTHORN LAKE

Location: Alachua County
Size: 87 acres
Depth: 12 feet (approx.)

Problem and Source: Lake is eutrophic with high organic color in water. It receives some effluent from the town of Hawthorn.

Background Data: See description for Lake Alice.

LAKE HOLLINGSWORTH

Location: Polk County
Size: 356 acres
Depth: 7 feet (approx.)

Problem and Source: Lake is eutrophic. It receives urban drainage from Lakeland area.

Rehabilitation: The life history of the largemouth black bass has been studied in this lake and hatchery brood stock has been obtained from here. Artificial spawning substrate was tried unsuccessfully as it sank into the organic bottom.

Background Data: Data has been collected annually since 1966 by the Game and Freshwater Fish Commission and the lake serves as a recreational area on the Florida Southern College campus.

INGLIS RESERVOIR

Location: Citrus County
Size: 3,500 acres (approx.)
Depth: 20 feet (approx.)

Problem and Source: Lake contains numerous aquatic weeds, primarily the exotic hydrilla.

Rehabilitation: A 200-acre test plot from nearly 2,000 infected acres was treated with diquat and copper. Results were temporary control but also precipitated a fish kill from oxygen depletion.

Background Data: Surveys have been made by the Florida Game and Freshwater Fish Commission, U. S. Department of Agriculture, and the U. S. Army Corps of Engineers.

Comments: This fifty-year-old Florida Power Corporation Reservoir was planned to be utilized as a water storage basin on the Cross Florida Barge Canal.

LAKE JESSIE

Location: Polk County
Size: 190 acres
Depth: 14 feet (approx.)

Problem and Source: Lake is eutrophic and receives domestic sewage effluent.

Background Data: Florida Game and Freshwater Fish Commission has collected data annually since 1966.

LAKE KILLARNEY

Location: Orange County
Size: 237 acres
Depth: 23 feet (approx.)

Problem and Source:	Lake has excessive weed growth, primarily hydrilla. The water is clear at present but is believed to have had algal blooms prior to exotic weed infestation. Lake receives heavy urban and residential drainage.
Rehabilitation:	Chemical treatments tried in the past have not provided satisfactory control.
Background Data:	The Florida Game and Freshwater Fish Commission has sampled annually since 1966.

LAKE LAWNE

Location:	Orange County
Size:	156 acres
Depth:	6 feet (approx.)

Problem and Source:	Lake is hyper-eutrophic, and receives domestic sewage effluent.
Background Data:	The Florida Game and Freshwater Fish Commission has sampled annually since 1966.

LAKE LOCHLOOSA

Location:	Alachua County
Size:	6,138 acres
Depth:	10 feet (approx.)

Problem and Source:	Lake is eutrophic and experiences profuse algal blooms. The trophic condition is at least partially the result of edaphic considerations; no major cultural sources of nutrients; drainage from fertilized pasture land may be one nutrient source.
Background Data:	Same as Lake Alice.

LAKE LULU

Location: Polk County
Size: 301 acres
Depth: 11 feet (approx.)

Problem and Source:	Lake is hyper-eutrophic; it receives municipal sewage, waste from canneries, and urban drainage and is the farthest downstream of the Winter Haven Chain of Lakes.
Background Data:	Inventory of polluting sources was made in 1948 by Polk County Health Department. Florida Department of Air and Water Pollution Control made a survey in 1970. Florida Game and Freshwater Fish Commission has sampled annually since 1966.

LAKE MAGGIORE

Location: Pinellas County
Size: 388 acres
Depth: 4 feet (approx.)

Problem and Source:	Lake is brackish and hyper-eutrophic. During 1927, land developers created conditions that permitted salt water intrusion. Repeated cycles from fresh to salty water and heavy algal blooms have caused many extensive fish kills. The shoreline is densely populated at present.
Rehabilitation:	Fish have been restocked.
Background Data:	Pinellas County Health Department sampled in 1954. A publication by George K. Reid relating to a fish kill was made in Vol. 27 of Quarterly Journal of Florida Academy of Sciences. Florida Game and Freshwater Fish Commission has sampled annually since 1966.

LAKE MAITLAND

Location: Orange County
Size: 451 acres
Depth: 18 feet (approx.)

Problem and Source: The lake experiences excessive weed growths, especially hydrilla. The source is mainly street drainage from residential and urban areas.

Rehabilitation: The city of Winter Park has operated mechanical weed harvesters in the lake for several years.

Background Data: The U.S. Geological Survey has sampled the lake since 1959, and the Florida Game and Freshwater Fish Commission since 1966.

LAKE McLEOD

Location: Polk County
Size: 512 acres
Depth: 10 feet (approx.)

Problem and Source: This is one of several lakes in central Polk County which are adversely affected by hydrologic changes caused by extensive groundwater pumpage.

Rehabilitation: Plans are to divert drainage of the Winter Haven Chain of Lakes into Lake McLeod to maintain desirable water levels.

Background Data: Lake Region Boating Association of Winter Haven and Southwest Florida Water Management District have conducted surveys. Hydrologic effects are explained in U.S. Geological Survey's Report of Investigations No. 49, by Matthew I. Kaufman of Florida State Board of Conservation.

LAKE MUNSON

Location: Leon County
Size: 255 acres
Depth: 5 feet (approx.)

Problem and Source: The lake is hyper-eutrophic. Source of nutrients is the Tallahassee sewage treatment plant effluent. (5.40 m.g.d. combined capacity of two plants).

The smaller of the plants has installed a field irrigation system to handle their 0.9 m.g.d.

Background Data: The Florida Game and Freshwater Fish Commission has sampled the lake annually since 1966.

NEWNAN'S LAKE

Location: Alachua County
Size: 6,331 acres
Depth: 6 feet (approx. average) 15 feet (max.)

Problem and Source: Lake is hyper-eutrophic with high organic color in water and profuse algal blooms (Aphanizomenon flos-aquae). Trophic condition is at least partially the result of edaphic considerations. There are no major cultural sources of nutrients. but drainage from fertilized pasture land may be a factor.

Rehabilitation: Striper bass have been stocked as an experimental control for gizzard and threadfin shad.

Background Data: See description for Lake Alice.

LAKE OKEECHOBEE

Location: Palm Beach County
Size: 448,000 acres
Depth: 14 feet (approx.)

Problem and Source: Lake is eutrophic; condition is probably contributed to by agricultural run-off and edaphic condition of tributary streams; plus sewage effluent from Clewiston,Okeechobee, Pahokee, and other more distant sources.

Rehabilitation: Wildlife and water management agencies are cooperating to prolong the lifetime of this important lake.

Background Data: Many studies have been made by several agencies. Florida Game and Freshwater Fish Commission has surveyed chemical, physical, and biological parameters since 1949.

ORANGE LAKE

Location: Alachua County
Size: 7,673 acres
Depth: 12 feet (approx.) 6 feet (average)

Problem and Source: Lake is eutrophic with profuse algal blooms and some aquatic weed problems. The trophic condition is at least partially the result of edaphic considerations plus drainage from fertilized pasture land and sewage from towns of Orange Lake and McIntosh which may be partial nutrient sources.

Background Data: See description for Lake Alice.

LAKE PARKER

Location: Polk County
Size: 2,272 acres
Depth: 10 feet (approx.)

Problem and Source: Lake is eutrophic and receives thermal discharge from a power plant and urban runoff.

Rehabilitation: Lake was renovated and restocked with desirable fish species in 1960. An unauthorized release of the exotic fish, Tilopia aurea, has made the lake the nucleus for infestations to nearby areas. Experiments with striper bass as a biological control for gizzard and threadfin shad have been conducted.

Background Data: The Florida Game and Freshwater Fish Commission has sampled chemical and biological parameters since 1962.

RODMAN RESERVOIR

Location: Oklawaha Basin, Marion County
Size: 13,000 acres (approx.)
Depth: 15 feet (approx.)

Problem and Source: This newly created reservoir has excessive weed growth; primarily hyacinths, southern naiad, and coontail. Dissolved oxygen is below minimum state water quality standards through summer months because of intensive weed spraying with chemicals and edaphic conditions following the inundation of the swampy flood plain in 1968.

Rehabilitation: A two-foot drawdown during winter months is designed for weed control.

Background Data: Surveys are being made by the U. S. Army Corps of Engineers, U. S. Geological Survey, U. S. Fish and Wildlife Service, Florida Game and Freshwater Fish Commission, and Florida Defenders of the Environment.

Comments: The reservoir was impounded as a water storage area on the Cross Florida Barge Canal. Much pressure is being exerted to drain the reservoir to the natural river channel.

LAKE ROWELL

Location: Bradford County
Size: 364 acres
Depth: 7 feet (approx.)

Problem and Source: Lake is eutrophic with algal blooms and unbalanced fish population. It receives sewage effluent from the town of Starke.

Background Data: Florida Game and Freshwater Fish Commission has sampled annually since 1964.

LAKE SCOTT

Location: Polk County
Size: 285 acres
Depth: 9 feet (approx.)

Problem and Source: Lake is eutrophic.

Background Data: Florida Game and Freshwater Fish Commission has collected data since 1966.

LAKE SEMINOLE

Location: Pinellas County
Size: 458 acres
Depth: 7 feet (approx.)

Problem and Source: Lake is brackish and hyper-eutrophic. It receives urban drainage and sewage effluent from the town of Largo and Hi-Ridge Road sub-division.

Background Data: Data has been collected annually since 1965 by the Florida Game and Freshwater Fish Commission.

LAKE SHIPP

Location: Polk County
Size: 283 acres
Depth: 13 feet (approx.)

Problem and Source: Lake is eutrophic. Canneries and a fertilizer plant situated on the lake plus upstream urban drainage along the Winter Haven Chain of Lakes are considered to be the source of nutrients.

Background Data: A thorough survey of chemical, physical, and biological parameters was conducted in 1970 by the Florida Game and Freshwater Fish Commission.

LAKE SOUTH

Location: Brevard County
Size: 1,101 acres
Depth: 4 feet (approx.)

Problem and Source: Lake is brackish and eutrophic with heavy algal blooms and weed infestation. Titusville sewage and runoff from a sub-division and citrus groves are thought to be the primary sources of nutrients.

Background Data: U. S. Geological Survey has collected data since 1957. Florida Game and Freshwater Fish Commission has collected data since 1966.

LAKE TALQUIN

Location: Gadsden County
Size: 8,850 acres
Depth: 33 feet (approx.)

Problem and Source: In 1957 the power dam broke. After repairs and refilling, complaints of poorer fishing success were frequent. The lake receives sewage from Quincy and Havana.

Rehabilitation: Selective treatment for shad was made in 1961.

Background Data: A survey was conducted by the Cooperative Fish Parasite and Disease Project at Auburn University and Florida Game and Freshwater Fish Commission in 1966, and data has been collected annually since that time.

LAKE THONOTOSASSA

Location: Hillsborough County
Size: 819 acres
Depth: 16 feet (approx.)

Problem and Source: The lake is eutrophic with periodic high B.O.D. and numerous fish kills. The source is a creek carrying combined dairy, food processing, cannery, and municipal wastes.

Rehabilitation: Upgrading waste treatment is underway.

Background Data: Department of Biology of Florida Southern College, Florida Department of Air and Water Pollution Control, and Florida Game and Freshwater Fish Commission have done surveys.

LAKE TOHOPEKALIGA

Location: Osceola County
Size: 18,810 acres
Depth: 8 feet (approx.)

Problem and Source: Lake is moderately eutrophic. The water has organic stains and supports frequent algal blooms. Six sewage treatment plants (combined design capacity of 9.4 m.g.d.) discharge into the lake; as well as dairy waste, pasture runoff and urban drainage.

Rehabilitation: The Kissimmee River Chain of Lakes supports one of the most dynamic sport fisheries in Florida. Documentation of an experimental drawdown that will simulate the natural drought cycles is in progress. The purpose is to oxidize organic bottom sediments, improve the littoral zone, and evaluate results as a management tool.

A separate habitat manipulation study is also underway to test benefits derived from fish attractors (brush and rock piles). The "preventive" projects are designed to insure desirable lake benefits in an area of heavy projected population growth and land development.

Background Data: The U. S. Geological Survey has sampled since 1954. The U. S. Army Corps of Engineers and Southwest Florida Water Management District have made surveys, and Florida Game and Freshwater Fish Commission has sampled annually since 1966 and intensively during 1970.

LAKE TRACY

Location: Polk County
Size: 136 acres
Depth:

Problem and Source: The lake suffers annual fish kills during the peak citrus season in addition to aquatic weed problem. Effluent from two citrus processing plants enter the lake.

Rehabilitation: A sprinkler cooler system for citrus wastewater was installed on the lake to prevent thermal cap which apparently was the cause of oxygen depletion.

Background Data: Suni-Citrus Products Co. of Haines City and Florida Game and Freshwater Fish Commission have sampled the lake since 1966.

LAKE TSALA APOPKA

Location: Hernando County
Size: 19,111 acres
Depth: 13 feet (approx.)

Problem and Source: Lake receives sewage effluent of Inverness, Brooksville, and Dade City. Interruption of natural drainage by extensive diking during periods of drought add to problems.

Background Data: Florida Game and Freshwater Fish Commission has collected data annually since 1963.

LAKE UNDERHILL

Location: Orange County
Size: 147 acres
Depth: 23 feet (approx.)

Problem and Source: The lake is eutrophic and receives airport and urban runoff.

Background Data: Data has been collected annually since 1966 by Florida Game and Freshwater Fish Commission.

Comments: A causeway is planned which will bisect the lake with about eleven acres of fill.

LAKE VIRGINIA

Location: Orange County
Size: 223 acres
Depth: 23 feet (approx.)

Problem and Source: Lake has prolific aquatic weeds. It receives urban drainage.

Rehabilitation: In 1966, Vallisneria sp. was the predominant vegetation which the City of Winter Park harvested with a mechanical weed-cutter. Succession was by hydrilla for which a satisfactory control has not been found.

Background Data: Florida Game and Freshwater Fish Commission has collected data since 1966.

LAKE WALES

Location: Polk County
Size: 326 acres
Depth: 19 feet (approx.)

Problem and Source: Lake has excessive aquatic weeds, primarily hydrilla. Residential drainage is thought to be the source of nutrients.

Background Data: Florida Game and Freshwater Fish Commission has collected data since 1966.

LAKE WAUBERG

Location: Alachua County
Size: 255 acres
Depth: 16 feet (approx.)

Problem and Source: Lake is eutrophic and supports frequent and obnoxious algal blooms. No urban runoff, sewage or substantive agricultural runoff enters the lake. Potential nutrient additions from known sources seem inadequate to explain present conditions.

Background Data: See description for Lake Alice.

GEORGIA

HIGH FALLS LAKE

Location:	Monroe, Lamar, and Butts Counties
Size:	460 acres
Depth:	23 feet (max.)

Problem and Source: The lake is eutrophic with very high color, turbidity, and production. A swimming beach has been closed on occasions during the last few years because of high coliform counts. Fish kills have also occurred during the last few years downstream from the lake, perhaps caused by high H_2S concentrations in the outfall.

Background Data: The lake has been operated by the State Game and Fish Commission to control fish populations. The lake was studied over a 1-1/2 year period in 1969 and 1970 by the School of Civil Engineering, Georgia Institute of Technology.

LAKE JACKSON

Location:	Newton, Butts, and Jasper Counties
Size:	4,750 acres
Depth:	100 feet (max.)

Problem and Source: Lake is undergoing accelerated eutrophication as evidenced by algal blooms in spring and early summer. It receives 45 m.g.d. secondary effluent via the South River from the four metropolitan Atlanta area treatment plants.

Rehabilitation and Background Data: An economic and water quality study of Lake Jackson and the South River basin has been completed to determine necessary measures for upgrading the lake and stream to a level satisfactory for present and future uses. (Joint project of Georgia Water Quality Control Board and FWQA.)

HAWAII

No specific lakes in Hawaii are included in this report, but the following background information on Hawaiian lakes and quality was provided by Doak A. Cox, Director of the Hawaii Water Resources Research Center.

1) Hawaii has very few natural fresh water lakes, and those few are small. Even artificial reservoirs are small in number and in size. In salt waters there are a large number of estuaries, some of them stream mouths more or less cut off from the sea by beach bars except during and after floods, and a few lagoons.

   Very little ecological information has been collected on any of the freshwater lakes and ponds except Lake Waiau, an alpine crater lake in the tropics.

2) The following outline (Cox) provides further information on the various lake types in Hawaii:

   A) Natural fresh-water lakes and ponds

      1. Crater lakes: In the craters of cinder and tuff cones, all small.

         a. High elevation: Water perched on silt linings, and in the case of one alpine pond, Lake Waiau, over 13,000 feet altitude, possibly perched on permafrost. Most naturally filled with vegetation and silt, so converted to swamps. Many craters have small ponds after rains.

         b. Low elevation, phreatic water: One example, Green Lake, Hawaii, in natural condition. Another, Nomilo, Kauai, artificially connected by tunnel to the sea many decades ago to make into a mullet pond. Perhaps no other examples.

         c. Low elevation, isolated: Example, Salt Lake, Oahu, originally salt by evaporation, freshened by drilling an artesian well in late 1800's or early 1900's, and used for mullet. Now in process of partial fill for residential area. Perhaps no other examples, but several tight craters have temporary ponds after rains.

2. Lava-damned fresh-water lakes and ponds.

   One example, Wai Ta, Kauai, more a swamp than a lake, converted in early 1900's to a shallow reservoir. Probably many intermittent ponds.

3. Other fresh-water ponds. Origin uncertain, some may be formed by solution, some by landslides. Very few and very small. No information.

B) Artificial reservoirs:

1. Semi-seasonal, perhaps a dozen between 3 x 10^8 and 3 x 10^9 gallons storage volume. Many are stocked with fish.

2. Night and weekend storage. Probably more than 100 in the range 10^7 to 3 x 10^8 gallons storage volume.

C) Natural salt- and brackish-water lakes and ponds

1. Crater lakes (See A-1-b and A-1-c)

2. Lava-damned salt-water ponds. Several small ones.

3. Stream-mouth estuaries with beach bars.

4. Partly land-locked drowned-valley estuaries (Pearl Harbor)

5. Closed lagoons. Mostly swamps rather than lakes, many drained for agriculture or being filled for urban development.

D) Artificial salt- and brackish-ports.

Hawaiian fish ponds, rock-walled ports of reefs or estuarine arms. Mostly badly silted now, some clogged with vegetation. Many of those on Oahu filled or partially filled for urban development.

ILLINOIS

FOX CHAIN OF LAKES

Location: Lake County (Northwest Illinois)
Size: 6,400 acres (Principal Lakes: Catherine, Channel, Marie, Petite, Grass, Nippersink, Pistakee, and Fox)
Depth: 3 to 8 feet (average) 16 feet (max.)

Problem and Source: The problem in these lakes is excess algae due to nutrients. The source of the nutrients is thought to be effluent from municipal sewage treatment plants, seepage of effluent from private septic systems, agricultural runoff, dredging of shallow boat channels thru nutrient-rich muck type soils, and recirculation of nutrients from the extensive shallow area muds by wind, motor boating and bottom feeding fishes.

Rehabilitation: No known previous treatment of any magnitude has been undertaken.

Background Data:

1) Summary Report on Quality of Interstate Water, Fox River (Wisconsin-Illinois), USPHS, March, 1965.

2) 1963 Fox Chain O' Lakes Fisheries Investigations, Special Fisheries Report Number Four, Illinois Department of Conservation.

3) A Limnological Review as Related to the Fox Chain of Lakes, Water Quality Section, Illinois State Water Survey, Feb. 15, 1966.

Comments: Lakes are used very extensively for boating, fishing, swimming, water ski-ing, year-round residence. They are very close to a major population center (Chicago and suburbs).

INDIANA

BIG CHAPMAN LAKE

Location: Kosciusko County, 2 miles south of Oswego
T33N, R6E, Sec. 25-26
Size: 581 acres
Depth: 39 feet (max.) 10 feet (average)

Problem and Source: The Department of Natural Resources reports that aquatic vegetation has become a nuisance at the lake. There is not sufficient data available to indicate the source of the problem.

Rehabilitation: Chemical control for nuisance vegetation has been recommended.

BIG OTTER LAKE

Location: Steuben County, 5 miles north of Angola
T38N, R13E, Sec. 26-27
Size: 69 acres
Depth: 38 feet (max.) 26 feet (average)

Problem and Source: There are locally heavy growths of aquatic vegetation and nuisance blooms of blue-green algae have developed in recent years.

Rehabilitation: A program to chemically control algal blooms has been initiated. A survey will be undertaken to locate major nutrient sources and a program initiated to reduce phosphate contributions.

BIG TURKEY LAKE

Location: Steuben County, 9 miles southwest of Angola
T36N, R12E, Sec. 7-18
Size: 450 acres
Depth: 65 feet (max.) 16 feet (average)

Problem and Source: The Department of Natural Resources reports that aquatic vegetation is a nuisance at the lake. The reason for the problem has not been specified.

Rehabilitation: Chemical control of vegetation has been recommended.

BOWER LAKE

Location: Steuben County, 4 miles northwest of Pleasant Lake
T36N, R13E, Sec. 8
Size: 25 acres
Depth: 22 feet (max.)   11 feet (average)

Problem and Source: The lake produces nuisance blooms of blue-green algae. Areas of rooted vegetation are decreasing.

The lake receives drainage from marsh areas and agricultural muck land and is downstream from the discharge of the Angola municipal sewage treatment plant (0.85 m.g.d.).

Rehabilitation: The City of Angola is expected to add phosphate removal facilities to its sewage treatment plant by the end of 1972 and is expected to provide an advanced degree of waste treatment before the end of 1977.

BRUCE LAKE

Location: Fulton County, 6 miles northwest of Kewanna
T30N, R1E, Sec. 6
Size: 245 acres
Depth: 34 feet (max.)   7 feet (average)

Problem and Source: Algal blooms have reached nuisance proportions and are reportedly increasing in intensity. There are also dense growths of aquatic vegetation. The major nutrient contributors have not been identified.

Rehabilitation: A program to chemically control algal growth is being initiated.

CEDAR LAKE

Location: Lake County, 6 miles southwest of Crown Point
T34N, R9W, Sec. 26-27
Size: 781 acres
Depth: 16 feet (max.) 8 feet (average)

Problem and Source: The lake is surrounded by residential and some commercial development, with a year-round population of 10,000 and a summer population of considerably more. Limited individual waste treatment is afforded by septic tanks and poorly operating absorption fields.

Septic effluent reaching the lake is responsible for nuisance algal blooms and localized bacterial contamination.

Rehabilitation: Algal growth has been chemically controlled with several applications of copper sulfate each year. Sanitary sewer system and waste treatment facilities are needed.

Areas have been undergoing incorporation so that a sanitary sewer system and treatment facilities could be undertaken. Legal problems have now been resolved, but financing the program remains a problem.

CEDAR LAKE

Location: Whitley County, 8 miles north of Columbia City
T32N, R9E, Sec. 2-11
Size: 144 acres
Depth: 75 feet (max.) 27 feet (average)

Problem and Source: The Department of Natural Resources reports that aquatic vegetation is a nuisance at the lake. The reason for the problem has not been specified.

Rehabilitation: Chemical control of vegetation has been recommended.

DIAMOND LAKE

Location: Kosciusko County, 3 miles northwest of Silver Lake
T31N, R5E, Sec. 26-35
Size: 79 acres
Depth: 39 feet (max.)   16 feet (average)

Problem and Source: The lake is fairly shallow and has a problem with nuisance aquatic vegetation. There is not sufficient data available to permit the assessment of all nutrient sources.

Rehabilitation: Chemical control of nuisance vegetation has been recommended.

LAKE GEORGE

Location: Lake County, west of Hobart in city limits
T33N, R9W, Sec. 12
Size: 270 acres
Depth: 14 feet (max.)   5 feet (average)

Problem and Source: The lake supports nuisance algal growths and aquatic vegetation. In addition, the lake is silting in at an objectionable rate and localized areas of bacterial contamination have been identified.

Fourteen sewage treatment plants, including the City of Crown Point, are on the watershed, which is a rapidly developing suburban area. The sewage treatment plant serving the City of Crown Point has a designed flow of 1.80 m.g.d. The thirteen semi-public sewage treatment plants in the basin have a combined designed flow of less than 1.5 m.g.d.

Some of the soil eroded from home and highway construction sites in the watershed deposits in the lake.

Rehabilitation: The City of Crown Point is expected to provide facilities by the end of 1972, which will reduce the phosphate content of its sewage treatment plant effluent by at least 80 percent. The City of Crown Point is expected to construct facilities by the end of 1977, which will provide an advanced degree of treatment. The addition of advanced waste treatment facilities and provisions for phosphate removal may be required at other locations in the watershed.

GOLDEN LAKE

Location: Steuben County, 4 miles southwest of Angola
T36N, R13E, Sec. 5-8
Size: 119 acres
Depth: 31 feet (max.) 15 feet (average)

Problem and Source: The lake produces nuisance blooms of blue-green algae but areas of rooted vegetation are decreasing.

The lake receives drainage from marsh areas and agricultural muck land and is downstream from the discharge of the Angola municipal sewage treatment plant (0.85 m.g.d.).

Rehabilitation: The City of Angola is expected to add phosphate removal facilities to its sewage treatment plant by the end of 1972 and is expected to provide an advanced degree of waste treatment before the end of 1977.

HEATON LAKE

Location: Elkhart County, 6 miles northeast of Elkhart
T38N, R5E, Sec. 23-24
Size: 87 acres
Depth: 22 feet (max.) 7 feet (average)

Problem and Source: Aquatic vegetation has reached nuisance levels in the lake. It is believed that the primary source of nutrients reaching the lake is rural runoff. There is also a problem with decreasing water levels.

Rehabilitation: Chemical control of nuisance aquatic vegetation has been recommended.

HENDERSON LAKE

Location: Noble County, 1/2 mile west of Kendallville area
T35N, R11E, Sec. 32
Size: 22 acres
Depth: 30 feet (max.) 15 feet (average)

Problem and Source: The lake receives the effluent from the Kendallville municipal trickling filter sewage treatment plant, (1.5 m.g.d.),discharge from storm sewers and overflow from combined sewers. As a result, the lake is plagued by nuisance blooms of algae, fish kills, bacterial contamination, and accumulation of sludge deposits.

Rehabilitation: Dredging of the lake is planned along with diversion of storm water and improvements to the sewage treatment plant including phosphorus removal facilities. Plans have been approved for expansion of the sewage treatment plant and installation of surface aerators on the lake.

HOGBACK LAKE

Location: Steuben County, 5 1/2 miles southwest of Angola
T38N, R13E, Sec. 17
Size: 146 acres
Depth: 26 feet (max.) 10 feet (average)

Problem and Source: The lake produces nuisance blooms of blue-green algae, but areas of rooted vegetation are decreasing.

The lake receives drainage from marsh areas and agricultural muck land and is downstream from the discharge of the Angola municipal sewage treatment plant (0.85 m.g.d.).

Rehabilitation: The City of Angola is expected to add phosphate removal facilities to its sewage treatment plant by the end of 1972 and is expected to provide an advanced degree of waste treatment before the end of 1977.

LAKE OF THE WOODS

Location:	Marshall County, 5 miles southwest of Bremen T34N, R3E, Sec. 6-7
Size:	416 acres
Depth:	48 feet (max.) 15 feet (average)

Problem and Source: Aquatic vegetation in this lake is a nuisance. All tributaries to the lake originate in and flow through areas strictly agricultural in nature. It is felt that agricultural runoff contributes nutrients and silt to the lake.

Rehabilitation: A program to chemically control nuisance growth of aquatic vegetation has been recommended.

LITTLE BOWER LAKE

Location:	Steuben County, 2 miles northwest of Pleasant Lake T36N, R13E, Sec. 9
Size:	12 acres
Depth:	34 feet (max.) 12 feet (average)

Problem and Source: The lake produces nuisance blooms of blue-green algae but areas of rooted vegetation are decreasing.

The lake receives drainage from marsh areas and agricultural muck land and is downstream from the discharge of the Angola municipal sewage treatment plant (0.85 m.g.d.).

Rehabilitation: A program to chemically control algae has been initiated.

The City of Angola is expected to add phosphate removal facilities to its sewage treatment plant by the end of 1972 and is expected to provide an advanced degree of waste treatment before the end of 1977.

LITTLE OTTER LAKE

Location: Steuben County, 5 miles north of Angola
T38N, R13E, Sec. 26-27
Size: 34 acres
Depth: 37 feet (max.) 22 feet (average)

Problem and Source: There are locally heavy growths of aquatic vegetation and nuisance blooms of blue-green algae have developed in recent years.

Rehabilitation: A program to chemically control algal blooms has been initiated. A survey will be undertaken to locate major nutrient sources and a program initiated to reduce phosphate contributions.

LONG LAKE

Location: Steuben County at Pleasant Lake
T36N, R13E, Sec. 15-16
Size: 92 acres
Depth: 32 feet (max.) 17 feet (average)

Problem and Source: The lake produces nuisance blooms of blue-green algae. Areas of rooted vegetation are decreasing.

The lake receives drainage from marsh areas and agricultural muck land and is downstream from the discharge of the Angola municipal sewage treatment plant (0.85 m.g.d.).

Rehabilitation: A program to chemically control algae has been initiated.

The City of Angola is expected to add phosphate removal facilities to its sewage treatment plant by the end of 1972 and is expected to provide an advanced degree of waste treatment before the end of 1977.

LOST LAKE (HAWKS LAKE)

Location:	Marshall County, 1 mile south of Culver T32N, R1E, Sec. 28
Size:	43 acres
Depth:	10 feet (max.) 4 feet (average)

Problem and Source: The lake supports nuisance algal blooms. In the past, there have been heavy winter kills and fish have died in the summer as the result of nocturnal oxygen depletion during periods of heavy algal growth.

The lake has rapidly decreased in size during the past 50 years. A survey conducted in 1920 disclosed that the lake had an open water area of approximately 86 acres. The decrease in size and depth since 1920 may be attributed largely to downcutting of the outlet, a decrease in flow into the lake, increased ground water outflow, and natural aging processes.

The Town of Culver has an activated sludge type sewage treatment plant (0.30 m.g.d.) which discharges treated wastes to a tributary approximately 1/4 mile from the lake. Since this plant was placed in operation in 1953, the rate at which Hawks Lake is aging has been accelerated.

On the basis of a hydrological study made in 1959, the Indiana Flood Control and Water Resources Commission(Department of Natural Resources) concluded "that the effluent from the Culver Sewage treatment plant contributes materially to maintenance of lake level. Without this effluent, the lake would not have available a flow which represents a depth of nearly 5 inches over the lake surface per month, which offsets evaporation losses and possibly increased ground water outflow resulting from drainage operations." It was recommended that the effluent not be diverted around the lake.

Rehabilitation:	A dam has been constructed to maintain the lake level at about 12 feet and a program to chemically control algal concentrations was initiated.

PALESTINE LAKE

Location:	Kosciusko County, 1/2 mile east of Palestine T31N, R5E, Sec. 1-2
Size:	290 acres
Depth:	31 feet (max.) 4 feet (average)

Problem and Source:	The Department of Natural Resources reports that aquatic vegetation is a nuisance at the lake. This lake is shallow and receives considerable drainage from marsh and rural areas.
Rehabilitation:	Chemical control of nuisance vegetation has been recommended.

ROUND LAKE

Location:	Whitley County, 8 miles north of Columbia City T32N, R9E, Sec. 12
Size:	131 acres
Depth:	63 feet (max.) 18 feet (average)

Problem and Source:	The Department of Natural Resources reports that aquatic vegetation is a nuisance at the lake. The reason for the problem has not been specified.
Rehabilitation:	Chemical control of vegetation has been recommended.

SHRINER LAKE

Location:	Whitley County, 8 miles north of Columbia City T32N, R9E, Sec. 11
Size:	120 acres
Depth:	74 feet (max.) 36 feet (average)

Problem and Source:	The Department of Natural Resources reports that aquatic vegetation is a nuisance at the lake. The reason for the problem has not been specified.
Rehabilitation:	Chemical control of vegetation has been recommended

SILVER LAKE

Location:	Kosciusko County at the northwest corner of the Town of Silver Lake T30N, R6E, Sec. 6
Size:	102 acres
Depth:	33 feet (max.) 15 feet (average)

Problem and Source:	The Town of Silver Lake provides no treatment for wastes originating within its corporate limits. Limited individual waste treatment is afforded by septic tanks which are connected to municipal sewers opening to a ditch tributary to Silver Lake. Septic tank effluent reaching the lake via the ditch is responsible for nuisance algal blooms and localized bacterial contamination near the mouth of the ditch. Rural runoff and the effluent from an occasional septic tank around the lake contribute to the problem.
Rehabilitation:	The Town of Silver Lake has been ordered to provide sewage treatment facilities on or before the end of 1970. Excessive algal growth is chemically controlled.

SYLVAN LAKE

Location:	Noble County at Rome City T35N, R10E, Sec. 14-15
Size:	630 acres
Depth:	36 feet (max.) 10 feet (average)

Problem and Source:	The lake experiences dense algal blooms. Studies have indicated that Sylvan Lake is one of the most productive lakes in the world for which data are available.

The lake is enriched by the effluent from the Kendalville municipal sewage treatment plant which passes through Henderson Lake before reaching Sylvan Lake.

Rehabilitation: Algal growth is controlled by the application of copper sulfate.

Plans have been approved for the expansion of the Kendalville sewage treatment plant and the addition of phosphorus removal facilities.

SYRACUSE LAKE

Location: Kosciusko County at Syracuse
T34N, R7E, Sec. 5
Size: 414 acres
Depth: 34 feet (max.) 13 feet (average)

Problem and Source: The lake supports nuisance growths of aquatic vegetation. This is a shallow lake separated from Lake Wawasee by a marsh area. Although this lake receives a small portion of the surface water runoff from Syracuse, it is believed that the weed problem is related to natural aging processes.

Rehabilitation: Both mechanical and chemical methods have been employed to control nuisance aquatic vegetation.

TOWN LAKE

Location: Fulton County, 1/2 mile southwest of Akron
T30N, R4E, Sec. 24
Size: 22 acres
Depth: 20 feet (max.) 10 feet (average)

Problem and Source: The Town of Akron provides no treatment for wastes originating within its corporate limits. Limited individual treatment is afforded by septic tanks which are connected to municipal sewers. A portion of the septic tank effluent discharges to Town Lake. This discharge is responsible for nuisance algal blooms and bacterial contamination of the lake.

Rehabilitation: The Town of Akron has sewage treatment facilities under construction which will discharge outside of the Town Lake watershed.

WAUBEE LAKE

Location: Kosciusko County, 1 mile southeast of Milford
T34N, R6E, Sec. 21-22
Size: 187 acres
Depth: 51 feet (max.)   25 feet (average)

Problem and Source: The lake supports nuisance blooms of blue-green algae. Nutrient sources include rural runoff, marsh drainage, and runoff from a duck farm and processing plant.

Rehabilitation: A program to chemically control algae has been initiated. Improved methods of waste treatment and control have been employed at the duck farm and processing plant.

WEST OTTER LAKE

Location: Steuben County, 9 miles west of Angola
T27N, R12E, Sec. 29
Size: 118 acres
Depth: 31 feet (max.)   17 feet (average)

Problem and Source: The Department of Natural Resources reports that aquatic vegetation is a nuisance at the lake. The reason for the problem has not been specified.

Rehabilitation: Chemical control of vegetation has been recommended.

WINONA LAKE

Location: Kosciusko County at the south edge of Warsaw and the west edge of the Town of Winona Lake
T32N, R6E, Sec. 16-21
Size: 526 acres
Depth: 79 feet (max.)   30 feet (average)

Problem and Source: Gradual enrichment of the lake is responsible for nuisance algal blooms and localized patches of dense aquatic vegetation. Major nutrient sources are the effluent from the Winona Lake municipal sewage treatment plant and agricultural runoff.

Infrequent, accidental spills of industrial wastes permit small amounts of oil, suspended matter, and dairy wastes to enter storm sewers which discharge to the lake.

Rehabilitation: Plans have been approved for facilities which will permit the City of Warsaw to intercept and treat all sewage from the Town of Winona Lake. The Warsaw municipal sewage treatment plant dishcarges downstream from the Winona Lake outlet.

Algal and aquatic vegetation is controlled by the application of chemicals by the Winona Lake Improvement Association.

Comments: Used for boating, fishing, swimming, and year-round residences.

YELLOW CREEK LAKE

Location: Kosciusko County, 5 miles northwest of the Town of Silver Lake
T31N, R5E, Sec. 26-27
Size: 150 acres
Depth: 67 feet (max.) 32 feet (average)

Problem and Source: The Department of Natural Resources reports that aquatic vegetation is a nuisance to boaters. There are not sufficient data to adequately assess all nutrient sources; however, all streams entering the lake originate at the outlets from other lakes in the chain.

Rehabilitation: It has been recommended that nuisance weed growths be controlled chemically.

IOWA

No specific lakes in Iowa are included in this survey, however some general information on lake problems in Iowa was provided by James Mayhew, Assistant Superintendent of Biology with the Iowa State Conservation Commission.

1) In Iowa the man-made lakes and natural lakes can be roughly geographically separated into southern and northern sections.

2) The man-made lakes have not been in existence long enough to be effected greatly by sedimentation, although this problem does exist. In some of the large flood control impoundments, which are located on large main stem drainages, sedimentation has been quite severe. For example, Coralville Reservoir has lost 25% of its storage capacity at conservation pool in the first 10 years. Most of the man-made lakes designed for recreational use or municipal water supply have been protected through well planned watershed planning. There are, of course, several exceptions.

3) In the northern sections are many natural lakes, which are of limited recreational value because of shallow water and sedimentation. Several of these lakes have been dredged to increase maximum depth, mainly to prevent winter kill of fish. However, this is a costly process and has been undertaken on a quite limited basis.

KANSAS

CHENEY RESERVOIR

Location: 25 miles west of Wichita
Size:
Depth:

Problem and Source: This lake has deteriorated in quality to the extent that uses have been impaired and rehabilitation is desirable. The primary problem in the reservoir is a common one to shallow lakes in the western U. S., excessive dissolved solids, and is caused by average annual lake evaporation exceeding the total annual average precipitation.

Rehabilitation: A large-scale lake rehabilitation program would be in order for this lake. One method of renewal which has been investigated is to bypass the stream flows entering the reservoir which contain the greatest amounts of dissolved solids. Because the lowest flow streams usually contain the greatest dissolved solids concentrations, bypassing a relatively small quantity of water can affect a large reduction in dissolved solids concentration in the reservoir.

Background Data: A thorough study of physical, chemical, and biological parameters was carried out by the Civil Engineering Department of Colorado State University. Data was collected from November 1964 to September 1967 and resulted in development of a water budget, heat budget, and partial salt budget for the reservoir as well as data on turbidity, chemical quality of water, odor, bacteria, and algae. Perhaps the most significant contribution of the study is its suggestions for reducing the increase of dissolved solids in reservoirs.

"Evaluation of the Effect of Impoundment on Water Quality in Cheney Reservoir," Ward, J. C., and Karak, S., Sept., 1969 -- Sanitary Engineering Papers, Colorado State University, No. 4.

In addition to the specific lake included in this survey, some general background information on lakes and reservoirs in Kansas was provided by Keith S. Krause, Director of the Kansas Water Resources Board.

1) Kansas has no important natural lakes. There are over 70,000 farm ponds and approximately 400 reservoirs having 100 surface acres or more. Kansas does have a number of reservoirs which have silted in. These are small reservoirs from 20 to 100 acres in size which were built 35-40 years ago. There are no known reservoirs in the state whose uses have been seriously impaired as a result of eutrophication. A reservoir may receive floodwaters having large amounts of silt, organic, and bacterial content which makes them unfit for swimming for a week or ten days. Most of them clarify readily and use is resumed thereafter.

2) Kansas has no rehabilitation projects in the sense that eutrophication is being brought under control. They do anticipate that it will be necessary to consider silt removal sometime in the future in order to restore reservoir storage capability. They also encourage soil conservation and land treatment practices in the watersheds contributory to the reservoirs for reducing the amount of silt, bacteria, fertilizer, and organic matter entering the stream systems. About 20 percent of the area of the state is now in watershed districts, requiring 75 percent or more of the land to be under treatment. This does not represent the total effort being made in Kansas by any means. However, an exact inventory of these efforts is unavailable.

KENTUCKY

No specific Kentucky lakes are included in this survey. However, some information was provided by Charles C. Bowers, Jr., Director of the Division of Fisheries in the Department of Fish and Wildlife Resources.

1) The Division of Fisheries feels that several Kentucky lakes may be seriously impaired as a result of deterioration of water quality. However, data to document this is lacking.

2) Lake Cumberland receives silt and acid mine drainage from both strip mining and deep mining in the Cumberland Drainage Basin. The walleye population in the lake has suffered, but the total number of species occuring in the lake is on the increase due to new introductions.

3) Kentucky Lake receives a substantial load of industrial pollutants from the whole Tennessee River Valley. Fish populations are probably suffering, but studies on the lake are not conclusive.

LOUISIANA

CADDO LAKE

Location: Lat. 32°42'15" Long. 93°55'10"
Size: 32,640 acres
Depth:

Problem and Source: The problem is brine from oil field operations.

Rehabilitation: Pollution has been 90% eliminated through corrective action.

CALCASIEU LAKE

Location: Lat. 29°50'20" Long. 93°20'50"
Size: 42,880 acres
Depth: 7 feet

Problem and Source: Problem is mercury pollution. The source has not been positively established but it is believed to originate from industry in the Lake Charles area and from irrigation return water.

Rehabilitation: Continuation of investigation to determine the source of pollution has been proposed. Also, non-toxic treatment of rice growing operations is being considered.

CATAHOULA LAKE

Location: Lat. 31°34'30" Long. 92°03'38"
Size: 26,880 acres
Depth:

Problem and Source: Problem is brine from oil field operations.

Rehabilitation: Problem has been 90% eliminated.

COCODRIE LAKE

Location: Lat. 31°00'00" Long. 92°22'46"
Size: 19,456 acres

Problem and Source: Problem is silt pollution from runoff due to previous gravel dredging operations.

Rehabilitation: Continuation of investigation and possible control of runoff of rain water has been proposed.

CROSS LAKE

Location: Lat. 32°30'30" Long. 93°50'00"
Size: 8,832 acres
Depth:

Problem and Source: Problem is brine from oil field operations.

Rehabilitation: Problem has been 90% eliminated.

LAKE FAUSSE POINT

Location: Lat. 29°56'02" Long. 91°33'07"
Size: 15,360 acres

Problem and Source: There is a problem with oil on an intermittent basis.

Rehabilitation: Coordination with offenders to control/reduce pollution is needed; some has been done, more is needed.

LAKE PONCHARTRAIN

Location: Lat. 30°10'39" Long. 89°44'38"
Size: 397,440 acres
Depth: 15 feet

Problem and Source: Problem is with coliforms and phosphates, nitrates and nitrites from storm drain discharges.

Rehabilitation: Proposals include counting of fecal coliforms to determine water quality; control of water sports at certain times and areas; careful regulation of proposed chlorination of storm water.

Background Data: Data is available through Water Resources Research Institute, Louisiana State University.

SABINE LAKE

Location: Lat. 29°45'30" Long. 93°53'30"
Size: 55,680 acres
Depth: 7 feet

Problem and Source: The problem is oil pollution believed to emanate from local industry.

Rehabilitation: No corrective action has been taken; control of industry pollution emissions is proposed.

LAKE SALVADORE

Location: Lat. 29°41'20" Long. 90°12'13"
Size: 44,800 acres
Depth:

Problem and Source: The problem is brine and oil from drilling operations.

Rehabilitation: Coordination with offenders to control/reduce pollution is needed; some has been done, more is required.

SIX MILE LAKE

Location: Lat. 29°45'00" Long. 91°70'00"
Size: 19,200 acres
Depth: 15 feet

Problem and Source: The problem is silt from normal water action and Corps of Engineer activity.

Rehabilitation: There is no known solution to natural silting.

LAKE VERRET

Location: Lat. 29°49'24" Long. 91°06'31"
Size: 14,080 acres
Depth: 7 feet

Problem and Source: Pesticide from sugar cane spraying and fertilizer from water run-off are entering the lake. Primary areas of contamination are located to the north and east.

Rehabilitation: Discontinued use of Endrin has greatly reduced pollution; further research is needed to produce a non-toxic spray. Control of fertilizer usage seems to be the best technique.

MAINE

ANNABESSACOOK LAKE

Location: Monmouth and Winthrop Townships, Kennebec County
Size: 1,420 acres
Depth: 49 feet (max.)

Problem and Source: Lake has excessive algae and weed growth. Waste sources are largely domestic and industrial.

Rehabilitation: Applications of arsenite and copper sulfate, also routing of wastes away from the lake have been undertaken.

Background Data: Background data includes scientific investigation adequate to describe named problems. The data is available through Maine Inland Fish and Game, Maine Environmental Improvement Commission and University of Maine.

Comments: Lake is used for boating, fishing, hunting and trapping, public water supply, swimming and year-round residence.

BAUNEG BEG LAKE

Location: Sanford and North Berwick Township, York County
Size: 160 acres
Depth: 29 feet (max.)

Problem and Source: Lake has excessive algal growth. Waste source is largely domestic.

Rehabilitation: Application of copper sulfate has been made.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data are available through Maine Inland Fish and Game Commission.

Comments: Lake is used for boating, summer camping, fishing, swimming.

BONNY EAGLE LAKE

Location: Cumberland and York Counties
Size: 211 acres
Depth: 22 feet (max.)

Problem and Source: Lake has excessive algal growth.

Rehabilitation: There have been no previous treatments.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game and Maine Environmental Improvement Commission.

Comments: Lake is used for boating, summer camping, domestic water supply, fishing, hunting and trapping, and swimming.

COBBOSSEECONTEE LAKE

Location: 4 Townships in Augusta area of Kennebec County
Size: 5.543 acres
Depth: 100 feet (max.)

Problem and Source: Lake has excessive algal and weed growth. Waste sources are largely domestic and industrial.

Rehabilitation: Routing of wastes away from lake has been attempted.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game, Maine Environmental Improvement Commission, and University of Maine.

Comments: Lake is used for boating, fishing, hunting and trapping, power supply, public water supply, swimming and year-round residence.

COCHNEWAGON POND

Location: Monmouth Township in Kennebec County
Size: 385 acres
Depth: 28 feet (max.)

Problem and Source: Lake has excessive algal and weed growth; waste sources are largely agricultural and domestic.

Rehabilitation: Application of copper sulfate has been tried.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game and Maine Environmental Improvement Commission.

Comments: Lake is used for boating, summer camping, fishing, hunting and trapping, and swimming.

ESTES LAKE

Location: Sanford and Alfred Townships, York County
Size: 387 acres
Depth: 30 feet (max.)

Problem and Source: Lake has excessive algal and weed growth. Waste sources are largely domestic and industrial.

Rehabilitation: Installation of sewage treatment plants have been made.

Background Data: Background data includes scientific investigation adequate to describe named problems. The data is available through Maine Inland Fish and Game and Maine Environmental Improvement Commission.

Comments: Lake is used for boating, fishing, hunting and trapping, swimming, and year-round residence.

LITTLE OSSIPPE LAKE

Location: Waterboro Township, York County
Size: 564 acres
Depth: 74 feet (max.)

Problem and Source: Lake has excessive algal growth. Waste source is largely domestic.

Rehabilitation: There have been no previous treatments.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game Commission.

Comment: Lake is used for boating, domestic water supply, fishing, swimming and year-round residence.

LOVEJOY POND

Location: Albion Township, Kennebec County
Size: 324 acres
Depth: 32 feet (max.)

Problem and Source: Lake has excessive algal and weed growth. Waste source is largely agricultural.

Rehabilitation: Weed cutting has been done.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game Commission and Maine Environmental Improvement Commission.

Comments: Lake is used for boating, summer camp, fishing, hunting and trapping, and swimming.

MIDDLE RANGE POND

Location: Poland Township, Androscoggin County
Size: 366 acres
Depth: 66 feet (max.)

Problem and Source:	Lake has excessive algal growth. Waste source is primarily domestic.
Rehabilitation:	Treatment with copper sulfate has been attempted.
Background Data:	Background data include scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game Commission and Maine Environmental Improvement Commission.
Comments:	Lake is used for boating, summer camp, domestic water supply, fishing, hunting and trapping, and swimming.

NORTH POND

Location: Somerset and Kennebec Counties
Size: 2,115 acres
Depth: 20 feet (max.)

Problem and Source:	Lake has excessive algal growth. Waste source is primarily domestic.
Rehabilitation:	There have been no previous treatments.
Background Data:	Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game Commission, Maine Environmental Improvement Commission and University of Maine.
Comments:	The lake is used for boating, domestic water supply, fishing, hunting and trapping, swimming, year-round residence.

PATTEE POND

Location: Winslow Township, Kennebec County
Size: 712 acres
Depth: 27 feet (max.)

Problem and Source: Lake has excessive algal and weed growth. Waste sources are primarily agricultural and domestic.

Rehabilitation: There have been no previous treatments.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game Commission, Maine Environmental Improvement Commission and University of Maine.

Comments: Lake is used for boating, fishing, hunting and trapping, swimming, and year-round residence.

PUSHAW LAKE

Location: 4 Townships in Old Town area of Penobscot County
Size: 5,056 acres
Depth: 28 feet (max.)

Problem and Source: Lake has excessive algal and weed growth, and bacterial pollution. Source of waste is primarily domestic.

Rehabilitation: An attempt has been made to dredge a new outlet to improve flushing characteristics.

Background Data: Background data includes scientific survey based on limited sampling and analysis and judgement of competent witnesses. The data is available through Maine Inland Fish and Game Commission and University of Maine.

Comments: Lake is used for boating, fishing, hunting and trapping, swimming and year-round residence.

SABATTUS POND

Location: Green, Webster and Wales Townships, Androscoggin County
Size: 1,787 acres
Depth: 19 feet (max.)

Problem and Source: Lake has excessive algal and weed growth, and bacterial pollution. Waste sources are primarily agricultural and domestic.

Rehabilitation: Weed cutting and routing of wastes away from lake have been attempted.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game Commission and Maine Environmental Improvement Commission.

Comments: Lake is used for boating, domestic water supply, fishing, hunting and trapping, swimming, and year-round residence.

SCHOODIC LAKE

Location: Cherryfield and Columbia Townships, Washington County
Size: 389 acres
Depth: 37 feet (max.)

Problem and Source: Lake has excessive algal and weed growth. Waste sources are primarily agricultural and domestic.

Rehabilitation: There have been no previous treatments.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game Commission.

Comments: Lake is used for boating, summer camp, domestic water supply, fishing, hunting and trapping, and swimming.

SEBASTICOOK LAKE

Location: Newport Township, Penobscot County
Size: 4,288 acres
Depth: 50 feet (max.)

Problem and Source: Lake has excessive algal and weed growth. Waste sources are primarily domestic and industrial.

Rehabilitation: Applications of arsenite and copper sulfate have been tried. Shutdown of waste discharges have also been made.

Background Data: Background data includes scientific investigation adequate to describe named problems. The data is available from the Federal Water Quality Administration, Maine Inland Fish and Game Commission, and the University of Maine.

Comments: Lake is used for boating, domestic water supply, fishing, hunting and trapping, and swimming.

SPAULDING POND

Location: York County, Maine and Rochester County, N. H.
Size: 118 acres
Depth: 19 feet (max.)

Problem and Source: Lake has excessive algal and weed growth. Waste sources are primarily domestic and industrial.

Rehabilitation: There has been no previous treatment.

Background Data: Background data include scientific survey based on limited sampling,and analysis. The data is available from Maine Inland Fish and Game Commission.

Comments: Lake is used for boating, fishing, hunting and trapping, swimming, and year-round residence.

TAYLOR POND

Location: Auburn Township, Androscoggin County
Size: 625 acres
Depth: 44 feet (max.)

Problem and Source: Lake has excessive weed growth. Waste sources are primarily agricultural and domestic.

Rehabilitation: There has been no previous treatment.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game and Maine Environmental Improvement Commission.

Comments: Lake is used for boating, fishing, hunting and trapping, swimming, and year-round residence.

THREE MILE POND

Location: China, Vasselboro and Windsor Townships, Kennebec County
Size: 1,077 acres
Depth: 37 feet (max.)

Problem and Source: Lake has excessive algal growth. Waste source is primarily domestic.

Rehabilitation: Application of copper sulfate has been tried.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game Commission and Maine Environmental Improvement Commission.

Comments: Lake is used for boating, domestic water supply, fishing, hunting and trapping, swimming, and year-round residence.

TOGUS POND

Location: Augusta Township, Kennebec County
Size: 648 acres
Depth: 49 feet (max.)

Problem and Source: Lake has excessive algal and weed growth; waste source is primarily domestic.

Rehabilitation: Application of copper sulfate has been tried.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game and Maine Environmental Improvement Commission.

Comments: Lake is used for boating, summer camp, domestic water supply, fishing, swimming, hunting and trapping, and year-round residence.

TOOTHACKER POND

Location: Phillips Township, Franklin County
Size: 30 acres
Depth: 20 feet (max.)

Problem and Source: Lake has excessive algal growth. Waste sources are primarily domestic and industrial.

Rehabilitation: Application of copper sulfate and routing of wastes away from the lake have been tried.

Background Data: Background data includes scientific survey based on limited sampling and analysis. The data is available through Maine Inland Fish and Game Commission.

Comments: Lake is used for boating, summer camp, domestic water supply, fishing, and swimming.

WEBBER POND

Location: Vasselboro Township, Kennebec County
Size: 1,252 acres
Depth: 41 feet (max.)

Problem and Source:	Lake has excessive algal and weed growth. Waste sources are primarily agricultural and domestic.
Rehabilitation:	Application of copper sulfate has been tried.
Background Data:	Background data is in the form of judgement of a competent witness, and is available through Maine Inland Fish and Game Commission.
Comments:	Lake is used for boating, domestic water supply, fishing, hunting and trapping, swimming, and year-round residence.

MARYLAND

LAKE ROLAND

Location:	Baltimore area	
Size:	80 acres	
Depth:	12-15 feet (average)	2 feet (silted upper portion)

Problem and Source:	Silt has accumulated in the upper portion of the lake. Also, a carp population constitutes most of the fish biomass. Intense algal blooms occur periodically accompanied by foul odors. Sources of nutrients include 1) seepage from septic tanks, 2) wastes from tennis club on bank (known from dye tests to be entering the lake), 3) trunk sewer from city of Baltimore passes under the lake and may leak sewage. Although raw sewage is responsible for the existing problem, bacteriological counts have remained low enough that the lake has never been closed.
Rehabilitation:	A major reclamation and restoration program is being planned by local organizations (Kiwanis and Sierra Clubs). Drag-lines will be used in the silted areas, and eventually restoration of more diversified fish population is planned.
Comments:	Lake is located in a heavily populated residential area of Baltimore.

MASSACHUSETTS

ASHFIELD LAKE

Location: Ashfield
Size: 30 acres
Depth: 10.6 feet (mean)

Problem and Source: A bio-engineering survey conducted on October 10, 1968 showed the lake to be heavily infested with the following aquatic nuisance vegetation: Potomaqetor (pondweed), Elodea (waterweed) and algae. These nuisances can be controlled by the proper use of certain herbicides.

No municipal or industrial wastes enter the pond. Nature of the agricultural runoff is not known but is not suspected to be a source. Septic tanks and cesspools are more likely a nutrient source.

Rehabilitation: Will be treated in 1970 provided that local contributions are made available to the Department. Approximate treatment costs for control of aquatic nuisances have been estimated at $5,000 for a one-year program and $8,000 for a three-year program.

Comments: It is easily accessible with numerous cottages and a public beach; fishing, boating, and all other water contact sports are the principal use (not used as a water supply).

LAKE ASHMERE

Location: Hinsdale and Peru
Size: 184 acres
Depth: 8 feet (mean)

Problem and Source: All types of nuisance aquatic vegetation are present.

Rehabilitation: Control cost estimates have been set at $25,000 for a one-year program and $43,000 for a three-year program.

Comments: It drains into the Housatonic. It is easily accessible by public roads. Lake Ashmere was recently acquired by the Department of Natural Resources, and is used primarily for recreational purposes.

BARTLETT POND

Location: Northboro
Size: 45 acres
Depth: 10 feet (max.)

Problem and Source: Erosion has created deep silt beds and high dissolved nutrient levels. Terrestrial vegetation is encroaching along the shoreline. Dense aquatic weed growth exists over much of the remaining pond and thick growths of submergent weeds are present even in open water. The drainage into the pond comes from the Westboro state farm and piggery by way of another pond which abuts the pond. The upstream pond is in a similar condition to Bartlett.

Rehabilitation: A pond association had tried chemical weed control unsuccessfully and has also used a drag line to clear away muck from a small area of the beach exposing a gravel bottom. Treatment of this pond became too expensive for the assoication and they gave the property to the town of Northboro for a recreational area. Nothing has been done since this. The Division of Fisheries and Game reclaimed the pond in 1960 and introduced predatory fish but they could not control the infestation of undesirable fish caused by the extensive protective cover provided by the weeds.

The pond should be drained and dredging or bulldozing carried out. Weed control of emergent vegetation along the shoreline needs to be conducted.

BILLINGTON SEA

Location: Plymouth
Size: 270 acres
Depth: 7 feet (mean)

Problem and Source: A bio-engineering survey was made on August 22, 1969. Results of this survey showed the predominant nuisance aquatic vegetation to be Elodea (waterweed), Isoetes (quilwort), and algae.

Municipal and industrial wastes do not enter the lake. Agricultural runoff from several cranberry bogs may be a significant source of nutrient pollution. Seepage from septic tanks and/or cesspools, numerous around the lake may contribute nutrients also. No evidence of direct discharges from these facilities was noted during course of numerous biological surveys.

Rehabilitation: These nuisances can be controlled by proper use of herbicides. Approximate treatment costs have been estimated at $13,000 for a one-year program and $22,000 for a three-year program. This water body is included in Chapter 771 of the Acts of 1968 as amended. If a local contribution is made, Billington Sea will receive some treatment for aquatic weed control in 1970.

Comments: This water body has a public access and a Town Park and is heavily used for fishing, boating, bathing, and water skiing (not a water supply). Also, it is used for cranberry bog irrigation and flooding.

LAKE BUEL

Location: Monterey and New Marlborough
Size: 196 acres
Depth: 18 feet (mean)

Problem and Source: All species of aquatic nuisance vegetation are present in abundance. No municipal or industrial wastes enter the lake and agricultural runoff is doubtfully the problem source. Septic tank or cesspool seepage is more likely.

Rehabilitation: The approximate treatment costs for control of such nuisances is estimated at $18,000 for a one-year period and $25,000 for a three-year period.

Comments: This lake is part of the Housatonic drainage system; shoreline is rocky and wooded; habitation is well-developed with boat liveries, numerous camps, cottages, and picnic areas.

LAKE COCHITUATE

Location: Natick and Wayland
Size: 591 acres
Depth: 22 feet (mean)

Problem and Source:

Rehabilitation: Bio-engineering surveys conducted during 1968 indicate that a partial treatment of Lake Cochituate for control of algae and submersed aquatic weeds is necessary to prevent this lake from becoming eutrophied to the extent that recreational activities will be greatly reduced and rendered dangerous. Such a program has been estimated to cost approximately $18,000 for one year, and $30,000 for three years.

Background Data: This lake is controlled by the Department of Natural Resources and under Chapter 771 of 1968 the sum of $25,000 was made available to the Department of Natural Resources for a special study of this lake. This study included several algae treatments.

Comments: This lake is densely populated and readily accessible by many public roads. Considerable interest has been shown by citizens of the surrounding communities to investigate causes of pollution to Lake Cochituate and to seek remedies for aquatic nuisance control.

FLAX POND

Location:	Lynn
Size:	40 acres
Depth:	27 feet (mean)
Problem and Source:	A bio-engineering survey conducted on August 2, 1967, showed that this pond was infested with various forms of nuisance aquatic vegetation including Nymphaea(water lily), Elodea (waterweed), Potomageton (pondweed), and algae in high concentrations. The aquatic vegetation was so abundant that it interfered with all water contact sports and posed a danger to bathers. No municipal or industrial wastes enter the pond and agricultural runoff is not thought to be the source of the problem. Seepage from septic tanks and from cesspools is more likely.
Rehabilitation:	These nuisances can be controlled by the proper use of certain aquatic herbicides. The approximate treatment cost for control of aquatic nuisances has been estimated at $6,000 for a one-year program and $10,000 for a three-year program.
Comments:	It is densely populated and readily accessible from public highways.

FLINT POND

Location:	Worcester, Grafton, Shrewsbury
Size:	90 acres
Depth:	9 feet (mean)

Comments: It is part of the drainage system of the Merrimack River, and is easily accessible by public roads. There is a boat livery present with numerous cottages, and a well-developed Town Beach as well as many private beaches. Primary uses are recreational (not a public water supply).

HAGER POND

Location: Marlboro
Size: 30 acres
Depth: Less than 10 feet

Problem and Source: This pond receives drainage directly from the city of Marlboro's sewage disposal plant. It has been the source of an increasing number of complaints about dirty water and algae nuisance. Several fish kills have occurred due to oxygen deficiencies especially during dry summers. The pollution in this pond has spread downstream to additional ponds. In the past, this pond has provided refuge for waterfowl and had some fishing. Because of the pollution problem, it is becoming a less desirable spot.

Rehabilitation: Nutrient control by correction of Marlboro sewage disposal plant is necessary.

JORDAN POND

Location: Shrewsbury
Size: 20 acres
Depth: 5 feet (mean)

Problem and Source: Some of the aquatic nuisances present include Elodea (waterweed), Nymphaea (water lily) and algae.

Rehabilitation: Jordan Pond was treated for aquatic nuisance on June 11, 1969 at a cost of $1,350 under funds appropriated by Chapter 771 of the

Problem and Source:	Results of bio-engineering surveys show that this pond contains heavy growths of several species of aquatic vegetation which have severely interfered with all recreational activities. The major weed infestation is Myriophyllum (Milfoil).
Rehabilitation:	The Department of Public Health is presently establishing an aquatic weed control project at Flint Pond with the cooperation of the City of Worcester, and the Towns of Shrewsbury and Grafton under funds appropriated by Chapter 771 of the Acts of 1968. Treatment costs have been set at approximately $10,000 with at least 25% contributed by the local communities. An additional amount of $10,000 will be necessary for maintenance work over the next three years.

FOREST LAKE

Location:	Methuen
Size:	55 acres
Depth:	10 feet (mean)

Problem and Source:	On July 14, 1969, a Biologist of the Department made a bio-survey of Forest Lake. The results of this survey showed that at that time no aquatic nuisance control was necessary. No municipal or industrial wastes enter the lake. Agricultural runoff is not a significant problem now, but may have been a contributor in the past. Septic tanks or cesspool seepage may contribute to the problem.
Rehabilitation:	Proposed legislation is for future treatment and maintenance and the cost has been estimated at $5,000 for the next three years. This lake has been treated for aquatic nuisance control in past years with much success. Forest Lake is also included in those mentioned in Chapter 771 of the Acts of 1968 and may receive some treatment if future surveys show nuisance problems.

Acts of 1968. A local contribution of $375 was received for this project. The treatment was a complete success but it is anticipated that additional funds will be needed in the future for maintenance work. This maintenance cost has been estimated at approximately $700.

MYSTIC LAKE (UPPER)

Location: Winchester, Arlington, and Medford
Size: 200 acres
Depth: 82 feet (max.)   30 feet (average)

MYSTIC LAKE (LOWER)

Location: Arlington and Medford
Size: 111 acres
Depth: 79 feet (max.)   30 feet (average)

These two lakes will be considered together since they are closely related.

Problem and Source: Upper Mystic Lake has a trace of oxygen all the way to the bottom in August but when surveyed in 1970 after a high mortality of stocked trout the lake was found to be of high greenish color due to algae bloom and to have a severe pollution problem from salt, carbohydrates, zinc and sewerage. Lower Mystic Lake has an oxygen deficiency below 8 feet during the summer and a hard hydrogen sulfite problem. Fish populations are few in number, and the lake has noticeably deteriorated in the last few years.

Rehabilitation: Both of these ponds need pollution control methods and also removal of bottom mud to alleviate oxygen deficiencies.

NUTTING LAKE

Location: Billerica
Size: 67 acres
Depth: 5 feet (mean)

Problem and Source: The lake is plagued with nuisance aquatic vegetation. Agricultural runoff has been a problem in the past, but at present the main source of nutrients is probably overflow and seepage from septic tanks and cesspools.

Rehabilitation: The town of Billerica is proposing to eliminate all sources of nutrient pollution to this lake by constructing a sewer system. Such action should help considerably in reducing the growth of aquatic nuisance vegetation.

Approximate treatment costs for control of aquatic nuisances including algae has been estimated at $10,000 for a one-year program and $20,000 for a three-year program.

Comments: This pond is part of the drainage system of the Concord River. Habitation is dense with a boat livery and a town beach. Both these facilities are easily accessible by public roads.

PONTOOSUC LAKE

Location: Lanesborough and Pittsfield
Size: 505 acres
Depth: 15 feet (mean)

Problem and Source: In recent years nuisance aquatic vegetation has grown in abundance and is interfering with recreational activities. Dense growths of aquatic vegetation are a hazard to bathers and extremely dangerous to the young bather and water skier.

On October 8, 1969, a biologist of the Department made a bio-engineering survey of this water body; results of the survey showed the predominant aquatic nuisance to be Myriophyllum (Milfoil) which can be readily controlled with proper use of herbicides.

Municipal wastes (untreated) enter the lake periodically from malfunctioning sewer lines. Industrial wastes may enter along with the domestic wastes although frequency and number of such sources are not known. Agricultural runoff may be a slight problem in influent brook areas. Septic tank seepage probably enters the lake though no direct sources are known.

Rehabilitation: It was estimated that approximately 70% of Pontoosuc Lake will have to be treated at an approximate cost of $22,000. Follow-up treatments will cost approximately $10,000 providing that the ecology of the lake does not substantially change and new species are not introduced.

Comments: The lake is used primarily for boating, swimming, fishing and water skiing.

LAKE QUINSIGAMOND

Location:
Size: 1,051 acres
Depth: 42 feet (mean)

Problem and Source: Municipal and industrial wastes (untreated) enter the lake through storm drains carrying outflowing sewage during heavy rains or blockages. Agricultural runoff and septic tank seepage contributions are thought to be minimal.

Comments: Primary use of lake is recreation, swimming, boating, fishing, (not a drinking water supply, but there are wells nearby).

RESERVOIR POND

Location: Canton
Size: 225 acres
Depth: 4 feet (average)

Problem and Source: Bio-engineering surveys conducted during 1969 show that Reservoir Pond contains the following nuisance aquatic plants: Nymphaea (waterlily), Brasenia (watershield), Cabomba (fanwort) and algae. It is the opinion of the Biologist of the Division of Environmental Health that the control of nuisance aquatic vegetation at Canton Reservoir would benefit recreational programs of the Massachusetts Hospital School which is located on the shores of Reservoir Pond.

Rehabilitation: In checking with the Public Access Board, it was found than Canton Reservoir does not have a "Public Access." Section 2 of Chapter 772 of the Acts of 1969 clearly states that "no funds for the commonwealth shall be expended for a control program in waters to which there is not public access."

Comments: Reservoir is privately owned and controlled by the Plymouth Rubber Company.

LAKE SABBATIA

Location: Taunton
Size: 250 acres
Depth: 9 feet (mean)

Problem and Source: All types of nuisance aquatic vegetation are common.

Municipal and industrial wastes do not enter the pond. Agricultural runoff is probably responsible for nutrients which create the heavy algal blooms. There are relatively few homes served by septic tanks along the shore.

Rehabilitation: Approximate cost for control has been estimated at $18,000 for a one-year program and $30,000 for a three-year program. These costs include control of algae.

Comments: The shoreline is partially wooded but the lake is easily accessible by public roads. The Department of Natural Resources is building a bath house at Lake Sabbatia which will greatly increase bathing activities.

LAKE SHERMAN

Location: Brimfield
Size: 86 acres
Depth: 4.5 feet (mean)

Problem and Source: A bio-engineering survey conducted on September 6 , 1968, showed Utricularia (bladderwort) and Myriophyllum (Milfoil) throughout the pond and heavy growths of Sagitaria (arrowhead) and Pontedieria (pickerelweed) on the western shore. Some Potamogeon (pondweed) was found on the eastern shore.

Rehabilitation: On June 23, 1969, and July 30, 1969,these aquatic nuisances were chemically treated at a cost of $3,500 under funds appropriated by Chapter 771 of 1968.

Comments: At the present time, this lake has no "Public Access." It sould be desirable for the Town of Brimfield to obtain a "Public Access" so that Lake Sherman may be considered for future aquatic nuisance control programs.

SOUTH WATUPPA POND

Location: Fall River and Westport
Size: 1,283 acres
Depth: 10 feet (mean)

Problem and Source: The major aquatic nuisance is algae which can be controlled with copper sulphate in the proper concentration. Municipal wastes enter the pond through the overflow of storm drains.

Rehabilitation: In the years from 1960 through 1969 the lake was successfully treated for algae. During the summer of 1969 South Watuppa Pond was successfully treated for algae control at a cost of $14,280 under the appropriation accompanying Chapter 771 of the Acts of 1968. The City of Fall River and the Town of Westport contributed twenty-five percent of the total cost.

Approximate treatment costs have been estimated at $10,000 a year. It is recognized that more permanent steps are needed, i. e., elimination of nutrient inputs, rather than the temporary relief being afforded by annual treatment.

Comments: This pond is a very large pond and readily accessible to the public.

There has been considerable local interest shown in this pond and an association known as the Algae Control Committee has done much to promote legislation for its treatment.

STILES POND

Location: Boxford
Size: 60 acres
Depth: 14 feet (average)

Problem and Source: The lake is plagued with nuisance algae and aquatic weed growths.

Rehabilitation: Approximate treatment cost for aquatic nuisance control has been estimated at $10,000 for a one-year program and $20,000 for a three-year program.

Comments: This pond is part of the drainage system of the Parker River. The shoreline is heavily wooded but readily accessible by public road.

STUDLEY POND

Location: Rockland
Size: 26 acres
Depth: 3 feet (mean)

Problem and Source: On August 28, 1969, a Department Biologist made a bio-engineering survey and observed that Nymphaea (waterlily) and algae were the major aquatic nuisances.

Rehabilitation: These nuisances can be controlled at a cost of approximately $2,100 for a one-year program and $3,100 for a three-year program.

Comments: This is a warm water pond draining into the North River; the shoreline is partially wooded and the pond is readily accessible.

WATSON POND

Location: Taunton
Size: 94 acres
Depth: very shallow

Problem and Source: Supports all types of aquatic nuisance vegetation.

Rehabilitation: The Department of Natural Resources has funds for limited aquatic weed control work in Watson Pond. Approximate cost of treatment for aquatic nuisance control has been estimated at $10,000 for a one-year program and $20,000 for a three-year program.

Comments: This pond is under control of the Department of Natural Resources which has initiated an enormous expansion program at Watson Pond which includes a bathhouse for the bathing area and a skating rink.

MICHIGAN

BARTON LAKE

Location: Vicksburg, Kalamazoo County
T4S, R11W, Sec. 23, 26, 27
Size: 347 acres
Depth: 52 feet (max.)

Problem and Source: The lake receives the discharge from a paper mill and the Vicksburg Waste Water Treatment Plant.

Rehabilitation: Paper mill wastes will be diverted by June 1972 and the methods of removal of municipal wastes from the basin are being considered.

Comments: The lake receives the discharge from a paper mill and the Vicksburg Wastewater Treatment Plant, located 1 1/2 miles upstream. Estimated contributions to the lake in the fall of 1964 were:

		Pounds/day		
	PO_4	NO_3	NH_3-N	Org. N
Vicksburg WWTP	37.2	1.12	14.1	2.65
Simpson Lee Paper Co.	0.0	8.14	0.0	98.3

The Vicksburg trickling filter plant serves 2,224 people.

Part of a natural chain of lakes, flow-through time is probably greater than a year.

BEAR LAKE

Location: Muskegon County
T10N, R16W
Size: 415 acres
Depth: 10 feet (max.)

Problem and Source: Lake experiences severe algal blooms probably due to land runoff and natural eutrophication.

Rehabilitation: Copper sulfate has been used to control algae.

BETSIE LAKE

Location:	Benzie County T26N, R16W
Size:	250 acres
Depth:	22 feet (max.)

Problem and Source:	Municipal (plant serving population of 1,690) and industrial wastewater effluents discharge to this lake. Biological survey revealed suppression of benthic fauna in 1966.
Rehabilitation:	The municipal wastewater treatment plant is to be improved and include 80% phosphorus removal by 1972.
Background Data:	There was a biological survey in 1966.

BRIGHTON LAKE

Location:	Brighton, Livingston County T2N, R5E, Sec. 36; T2N, R6E, Sec. 31
Size:	600 acres
Depth:	unknown

Problem and Source:	The lake has a long history of algal problems. It receives effluent from the Brighton Waste Water Treatment Plant (trickling filter type serving 2,282 people).
Rehabilitation:	Phosphorus removal (80%) at the treatment plant began in the summer of 1970.
Comments:	Lake is part of a chain of lakes with a flow-through time of greater than one year. Algal problems are so severe that a boy scout camp on the lake has been closed.

CHEMUNG LAKE

Location:	Livingston County T2N, R5E
Size:	310 acres
Depth:	70 feet

Problem and Source: Rooted aquatic plants grow profusely in the lake's shallow areas. The shoreline is heavily urbanized and in many places homes are crowded on small lots that are just above the lake level. Soluble nutrients from septic tank systems which serve these homes probably infiltrate the ground water and eventually reach the lake.

Rehabilitation: Collection and diversion of sewage from the basin has been suggested.

Background Data: Some water chemistry analyses were done in 1967.

Comments: This lake has a very small watershed (4.34 square miles), is relatively deep, and has a regular shoreline with very few coves and bays. These features indicate low productivity.

DEER LAKE

Location: Ishpeming, Marquett County
T48N, R27W, Sec. 26-29; 32-34
Size: 897 acres
Depth: unknown

Problem and Source: The lake has a problem with serious blue-green algae and a deteriorating fish population. The nutrient source is the Ishpeming Waste Water Treatment Plant (primary type serving 8,800 people).

Rehabilitation: Phosphorus removal (80%) from municipal effluents is planned.

Comments: Lake has a controlled outlet. Flow-through time is estimated at about one year.

FIRST LAKE

[illegible]
Size: 40 acres
Depth:

Problem and Source: Primary effluent from a municipal wastewater treatment plant is discharged to the lake. Algal blooms have reached severe proportions.

Rehabilitation: Wastewater will be disposed on land by 1972.

Background Data: A water quality survey in 1964 showed high phosphorus, nitrogen and biochemical oxygen demands in the lake water.

Comments: The shoreline of this lake has not been developed for residential use and the drainage area is small.

FORD LAKE

Location: Washtenaw County, southeast of Ann Arbor
Size: 1,049 acres
Depth: 38 feet (max.)

Problem and Source: The lake is undergoing rapid eutrophication with severe algal blooms. It receives seepage from septic tanks and municipal treatment plant effluent.

Rehabilitation: Phosphorus removal (80%) is planned for upstream communities by December 1972. Rehabilitation might also involve a dredging operation in addition to elimination of nutrient sources.

Background Data: Chemical and biological background data on this lake have been accumulating for approximately the past five years from a group of scientists from the Biology Department at Eastern Michigan University, led by Dr. John Bates.

FREMONT LAKE

Location: Newaygo County
T12N, R14W, Sec. 2-4, 9-11
Size: 790 acres
Depth: 88 feet (max.)

Problem and Source: The lake has a long history of algal blooms and a shallow thermocline. It receives effluent from the Fremont trickling filter treatment plant, serving a population of 3,400.

Rehabilitation: Community is investigating various methods for removing the effluent presently entering the lake by 1972.

Comments: This is a spring-fed lake with a flow-through time exceeding one year. Lake discharges to a small creek which flows into the Muskegon River.

HEMLOCK LAKE

(See Pigeon River Lakes)

JORDAN LAKE

Location: Barry County
T5N, R7W
Size: 400 acres
Depth: 53 feet (max.)

Problem and Source: Secondary effluent from a municipal wastewater treatment plant (serving a population of 1800) is discharged to the lake. Algal blooms are numerous and intense.

Rehabilitation: Municipal wastewater will be diverted from the lake in fall of 1971. (Spray irrigation is planned).

Background Data: Dissolved oxygen depth profiles and limited chemical analysis were done in 1970.

Comments: Lake is used for swimming, fishing, and year-round residences.

KENT LAKE

Location: Oakland County
T2N, R7E
Size: 1,200 acres
Depth: 38 feet (max.)

Problem and Source: Algae blooms are intense and frequent. Secondary municipal wastewater effluent from a city of 4,323 people is discharged to the lake.

Rehabilitation: Phosphorus removal (80%) equipment is being installed at the wastewater treatment plant. Completion is expected by summer of 1971.

LAKE LANSING

Location: Ingham County, Michigan (5 miles from Michigan State University)
Size: 452 acres
Depth: 35 feet (max.)
37% surface area less than 5 feet; 79% less than 10 feet

Problem and Source: Lake Lansing is undergoing rapid eutrophication. Its problems include excessive aquatic weed growths, bacterial contamination, unbalanced fish population and 12 feet of bottom sediments. Sewage seepage is the primary cause of the problem.

Rehabilitation: A local group, led by the Ingham County Drain Commissioner, has a current proposal with F.W.Q.A. to rehabilitate the lake by dredging. A sewer system was installed in 1964 which should curtail further nutrient inputs.

Background Data: Background data on the history of this lake and surrounding areas as well as technical information is available. Technical data include extensive water chemistry records including phosphorus, nitrogen, and other classical measurement such as hardness, alkalinity, dissolved oxygen, and so forth. Extensive investigations have also been conducted on the sediment composition in various areas in the lake. Historical information on aquatic weeds and fish populations is available. Although not extensive, there is also some information available on the nutrient input to the lake as well as some bacteriological information. Surveys were conducted in late 1950's and again in 1969-70.

Comments: Lake has 20,000 feet of shoreline; (86% private, 14% public).

LOBDELL LAKE

Location: Genesee County
T5N, R6E
Size: 545 acres
Depth: 78 feet (max.)

Problem and Source: The lake has a very large crop of rooted aquatic plants. The large drainage area contributes nutrients from surface water runoff.

Background Data: Limited water chemistry was done in 1967.

Comments: This lake has a very large shoreline area because of many finger-like coves.

MACATAWA LAKE

Location: Ottawa County
T5N, R16W
Size: 2,218 acres
Depth: 40 feet (max.)

Problem and Source: Lake experiences severe and frequent algal blooms. Industrial and municipal wastewater effluents enter the lake. A large watershed drains to this drowned river mouth lake.

Rehabilitation: Secondary treatment and 80% phosphorus removal will be accomplished by 1972.

Background Data: Biological and chemical studies were done in 1964.

MANISTEE LAKE

Location: Manistee County
T21N, R16W
Size: 930 acres
Depth: 49 feet (max.)

Problem and Source: Deterioration of lake quality has occurred due to chloride and suspended solids wastewater discharges from industries.

Rehabilitation: Diversion of industrial wastewater discharges from basin are planned by 1972.

Comments: The lake maintains an excellent salmonoid fishery. in addition to a warmwater fishery.

MONA LAKE

Location: Muskegon Heights, Muskegon County
T9N, R16W, Sec. 7-9; T9N, R17W, Sec. 12-14
Size: 695 acres
Depth: 42 feet (max.)

Problem and Source: The lake has a long history of algal blooms. Muskegon Heights Waste Water Treatment Plant discharges effluent to Black Creek, a short distance above Mona Lake. (Plant is activated sludge type and serves 19,000 people).

Rehabilitation: Local residents apply copper sulfate for algae control. A spray irrigation project founded by the FWQA will eliminate much of the pollutional loading to Mona Lake. (Planned to be in operation by December, 1972).

Comments: Black Creek flows into the lake and discharge is directly to Lake Michigan. Flow-through time is probably greater than a year.

MUSKEGON LAKE

Location: Muskegon County
T10N, R16W
Size: 4,150 acres
Depth: 70 feet (max.)

Problem and Source: The lake has problems which include excessive weed growth and algal blooms, also oil deposits. Municipal and industrial waste water effluents have added to the deterioration of water quality.

Rehabilitation: Diversion of all municipal and industrial wastewater is planned by December, 1972.

LAKE ODESSA (JORDAN LAKE)

Location: Ionia County
Size: 430 acres
Depth: moderate depth

Problem and Source: Lake is seriously threatened by accelerated eutrophication, the importance of which is magnified by its high visibility.

Background Data: A study on algae blooms was conducted on this lake a few years ago. Results are written up in a Ph.D. thesis.

ORE LAKE

Location: Livingston County
T1N, R5E
Size: 220 acres
Depth: 81 feet (max.)

Problem and Source: Algae blooms are severe and frequent. The lake receives the outflow from Brighton Lake which receives effluent from municipal wastewater treatment plant.

Rehabilitation: Phosphorus removal (80%) began in summer of 1970.

Background Data: A limited chemical and biological survey was conducted in 1965.

PIGEON RIVER LAKES

HEMLOCK LAKE

SECTION-4 LAKE

Location: Northern part of lower peninsula, Michigan

	HEMLOCK LAKE	**SECTION-4 LAKE**
Size:	4 acres	2 1/2 acres
Depth:	70 feet	80 feet

Problem and Source: Rapidly advancing eutrophication is the problem in this lake.

Rehabilitation: At the present time the Institute for Water Research at Michigan State University has a project involving Hemlock and Section-4 Lakes whereby they are attempting to bring about reversal of eutrophication by artificially aerating the lakes. One of the lakes was completely aerated throughout the summer and the other lake received aeration of only the hypolimnion. The data generated from this study are being evaluated at the present time and will be the subject of a Ph.D. thesis.

Background Data: Extensive limnological background data are available.

Comments: Lakes are rather remote and receive intermittant summer usage; low visibility lake.

RANDALL LAKE

Location: Coldwater, Branch County
T6S, R7W
Size: 220 acres
Depth: 35 feet (max.)

Problem and Source: Secondary municipal wastewater treatment plant effluent is discharged to the lake. Algal blooms and aquatic weeds reach nuisance proportions.

Rehabilitation: Phosphorus reduction (80%) will be in operation at the wastewater treatment plant by December 1972.

SECTION-4 LAKE

(See Pigeon River Lakes)

SIXTH LAKES (NO. 6)

Location: Montcalm County

Size: 34 acres
Depth: 18 feet (max.)

Problem and Source: Severe algal blooms occur regularly. Lake receives sewage stabilization lagoon effluent from city of 1,234 people.

WHITE LAKE

Location: Muskegon County
T11N, R18W
Size: 2,571 acres
Depth: 80 feet

Problem and Source: Excessive algal and weed growths occur regularly. Municipal and industrial wastewater enter the lake.

Rehabilitation: Effluent diversion is planned by 1973.

Background Data: Biological and nutrient study was conducted in 1967.

Comments: Flow through time is rapid (water changes approximately nine times each year).

MINNESOTA

AMBER LAKE

(See Fairmont Chain of Lakes)

BIG STONE LAKE

Location: Big Stone County
Size: 12,400 acres
Depth: 11 feet (mean)

Problem and Source: The lake experiences excessive algal and weed growth. Sources of nutrients include agricultural runoff, drainage from feedlots and barnyards, ground water, drainage from soil absorption systems near the lake, and industrial and domestic sewage outfalls entering the Whetstone and other rivers.

Rehabilitation: Rough fish removal was practiced from 1955-65.

Background Data: Fairly consistant sampling and analysis have been done since 1958 by Minnesota Conservation Department and Minnesota Health Department and the U. S. Geological Survey. For additional background see: "Some considerations related to the Fertility of Big Stone Lake" by John B. Moyle, Minnesota Department of Conservation, Division of Game and Fish, Special Publication No. 42 (1967).

Comments: Located in prairie agricultural area of Minnesota and South Dakota.

BRIGGS LAKE

Location: Sherburne County
Size: 406 acres
Depth: 14 feet (max.) 7 feet (median)

Problem and Source: Excess algal growth is the primary problem. Excessive shoreland development is probably the source of the problem.

Rehabilitation: Copper sulfate has been used since 1956 to control midsummer algal blooms and growths of submerged pondweeds. The local lake improvement association spends approximately $500 annually on these treatments.

Background Data: A fish and game lake survey was completed by the Department of Conservation on July 19, 1955 and includes information about physical and chemical characteristics of the lake.

Rough fish removal might decrease turbidity and available nutrients for algal blooms, but since this improvement in water quality would benefit only the immediate residents of the lake, state funds can not be spent for such a program.

BUDD LAKE

(See Fairmont Chain of Lakes)

BUFFALO LAKE

Location: Wright County
Size: 1,510 acres
Depth: 30 feet (max.)

Problem and Source: The lake's excessive algal growth is probably due to fertilization from sewage effluent.

Rehabilitation: Algal control by copper sulfate was initiated in 1940 and has continued since then.

Background Data: A Minnesota Department of Health Survey was conducted in 1934, Minnesota Department of Conservation lake survey on July 29, 1953, a fish kill investigation on September 7, 1966, and water analysis investigations in October, 1962 and 1970.

COTTON LAKE

Location: Becker County
Size: 1,916 acres
Depth: 19 feet (median)

Problem and Source: Nuisance aquatic weed growths are the major concern.

Rehabilitation: The lake has been improved temporarily by mechanical and chemical control measures. Rough fish (bullhead) removal was undertaken in 1956.

Background Data: The Minnesota Department of Conservation conducted a lake survey in 1956.

DEMONTROVILLE LAKE

Location: Washington County
Size: 156 acres
Depth: 8 feet (median)

Problem and Source: Excessive algal growth and fluctuating water levels are the primary concerns.

Rehabilitation: Installation of a well and pump were made in 1956 to maintain water levels. Copper sulfate to control algal blooms has been applied since 1958.

Background Data: The Minnesota Department of Conservation conducted a lake survey in 1961.

Comments: Winterkills in 1947 and 1950 occurred.

DETROIT LAKE

(See Pelican River Chain of Lakes)

FAIRMONT CHAIN OF LAKES

AMBER LAKE
BUDD LAKE
GEORGE LAKE
HALL LAKE
SISSETON LAKE

AMBER LAKE

Location: Martin County
Size: 179 acres
Depth: 20 feet (max.) 11 feet (mean)

Background Data: The Department of Conservation conducted a lake survey in 1954.

BUDD LAKE

Location: Martin County
Size: 179 acres
Depth: 11 feet (max.)

Background Data: The Department of Conservation conducted a lake survey in July, 1954. "Environmental Engineering," a report by the City of Fairmont, 1970, also contains data on the lake.

GEORGE LAKE

Location: Martin County
Size: 82 acres
Depth: 5.4 feet (mean)

Background Data: The Department of Conservation conducted a lake survey in July, 1954. There were reports of botulism poisoning in ducks on George Lake in August, 1970.

HALL LAKE

Location: Martin County
Size: 552 acres
Depth: 10 feet (max.)

Background Data: The Department of Conservation conducted Growth study tests (Base) in 1937, Test seining in 1940 and lake surveys in August, 1947, and September, 1953. There were investigations of use and effects of copper sulfate in algal control by the Minnesota Department of Health in 1946.

SISSETON LAKE

Location: Martin County
Size: 139 acres
Depth:

Background Data: The Department of Conservation conducted test seining in 1940, and a lake survey in July, 1954.

Comments: Winterkill occurred in 1946.

Problem and Source: All five of the Fairmont Chain of Lakes suffer from excessive algal growth resulting from a fertile watershed, and turbidity caused by wind action and movements of rough fish.

Up until 1952, there were five or six places where raw sewage was entering the lakes from the city of Fairmont storm sewers. Another source of nutrients was septic tanks from lakeshore homes.

Rehabilitation: The faulty sewer problems were corrected during the mid-1950's and by 1968 the lakeshore homes, previously served by septic systems, were annexed to the city and sewer and water service extended to them. This has made a clearly visible difference in the clarity and quality of the lake waters.

The siltation of the Fairmont Lakes has occurred over the last 10,000 years, with deposits of silt, sand, dead algae and plankton. Muddy water occurrs because of wind action, and the feeding habits of bullhead, carp, and quillback, which are bottom feeders, rooting in the silt for worms and micro-organisms. It was determined that the only remedy was to remove these rough fish, and dredge the silt from the lakes.

The Minnesota Conservation Deaprtment offered cooperation in the killing and disposal of fish. This project was accomplished in 1967, and it is estimated that a 95 to 100 per cent fish kill was made in all lakes, with the exception of bullhead species, which had an estimated kill of 30 to 90 per cent. The lakes were restocked with minnows, and game fish as well as fry and fingerlings and the lakes are well on the way to rehabilitation.

The City of Fairmont purchased a dredge and all necessary equipment in 1966 to dredge the five Fiarmont Lakes, a project estimated to take 20 years. George Lake was almost completely dredged in 1966, completed in 1967, with dredging on Sisseton Lake to be completed in 1970. Dredging of these lakes has made a remarkable improvement in the quality of the water, and it is estimated the completion of dredging these two lakes has given the City of Fairmont additional reservoir capacity equivalent to a half mile square lake, eight feet deep. The present maximum dredging depth is 25 feet. Before dredging started, it was noted that most of the shores of the lakes were mud covered, even those with sandy beaches were not too satisfactory. After dredging almost two lakes, the mud has been moved by wind and water currents to the dredged areas uncovering sandy beaches all around the lakes.

Because of long term copper sulfate treatments and increasing dosages of the chemical needed to control the blooms, it is believed that a strain of copper sulfate tolerant algae is developing in the Fairmont Chain.

Comments: The city of Fairmont obtains its municipal water supply from Budd Lake. Massive treatments of copper sulfate are made in the summer months to prevent algal blooms and associated taste and odor problems in the water supply.

FRANCIS LAKE

Location: Isanti County
Size: 318 acres
Depth: 7 feet (max.)

Problem and Source: The lake's problems include algal blooms and excess shoreland development.

Rehabilitation: Copper sulfate treatments have been made to control midsummer algal blooms. Mechanical removal of submerged aquatics near beach areas has been partially effective.

Background Data: The Minnesota Department of Conservation conducted a lake survey in October, 1960.

Comments: It is difficult to justify state expenditures on lake rehabilitation because little public benefit would result from such improvement. Winterkills occurred in 1940 and 1948.

GEORGE LAKE

(See Fairmont Chain of Lakes)

HALL LAKE

(See Fairmont Chain of Lakes)

JEFFERSON LAKE

Location: LeSueur County
Size: 2,290 acres
Depth: 17 feet (median)

Problem and Source: The lake experiences excessive algal growth due to fertile watershed and the action of rough fish.

Rehabilitation: Copper sulfate treatments have been made to control midsummer algal blooms. Rough fish removal was tried from 1956-1969 to decrease nutrient recycling from bottom sediments.

Background Data: The Minnesota Department of Conservation conducted lake surveys in 1951 and 1956, and in 1952 Creel Census and trapnetting reports. A Minnesota State Pollution Control Agency Report was issued in 1969. The Department of Conservation Reported on a fish kill in 1968 and on an odor problem in a bay of the lake in August, 1970.

Comments: Bullhead removal on a large scale would reduce nutrient recycling and decrease the algae problem. Local fishing interests, however, favor large bullhead populations at the expense of better water quality.

JULIA LAKE

Location: Sherburne County
Size: 137 acres
Depth: 15 feet (max.)

Problem and Source: The lake suffers from excess algal blooms due to fertile watershed and excessive shoreland development.

Rehabilitation: Copper sulfate has been used since 1940 to control midsummer algal blooms.

Background Data: The Minnesota Department of Conservation conducted a lake survey in 1958.

Comments: Improperly functioning septic tanks may be contributing to the lake problem, as well as turbidity caused by rough fish populations. The lake is located in the sandplain province.

LONG LAKE

Location: Isanti County
Size: 376 acres
Depth: 5 feet (median)

Problem and Source: The lake experiences excess algal blooms due in part to excess shoreland development.

Rehabilitation: Copper sulfate has been applied to control midsummer algal blooms.

Background Data: The Department of Conservation conducted a lake survey in 1963.

Comments: It is difficult to justify expenditure of state funds for rehabilitation since benefits would go only to lake residents. Winterkill occurred in 1945, 1947-50, 1954 and 1961.

LONG LAKE

Location: St. Louis County
Size: 157 acres
Depth: 33 feet (max.) 14 feet (median)

Problem and Source: Nutrient enrichment in the lake has resulted from septic tank effluent and mining activity in the watershed.

Rehabilitation: Copper sulfate to control algal blooms was used for the first time last year.

Background Data: The Minnesota Department of Conservation conducted a lake survey in June, 1955.

Comments: The small lake watershed and excessive shoreland development (40 dwellings per mile of shore) make algal blooms and other water problems common on the lake.

MADISON LAKE

Location: Blue Earth County
Size: 1,345 acres
Depth: 8 feet (median NE 1/2) 18 feet (median SW 1/2)

Problem and Source: The lake experiences excessive algal growth and fluctuating water levels.

Rehabilitation: Copper sulfate treatments have been tried for control of algal blooms.

Background Data: The Minnesota Department of Conservation conducted lake surveys in 1947 and 1955. A Creel census report was done during the winter (1945-46). A fish kill investigation was conducted in July, 1955.

MINNETONKA LAKE

Location: Hennepin County
Size: 14,310 acres
Depth: 25 feet (median)

Problem and Source: The lake suffers from excessive algal and weed growth due to complete urbanization of the watershed.

Rehabilitation: Some rehabilitation programs, including copper sulfate treatments, limited tertiary treatment of municipal wastes, water level control, and land use zoning have been attempted by small municipalities around the lake. Much of the work is through the Lake Minnetonka Conservation District.

Background Data: The lake has been studied extensively by Robert Megard of the Limnological Research Center, University of Minnesota.

LICAN RIVER CHAIN OF LAKES

DETROIT LAKE
LAKE MELISSA
LAKE SALLIE

DETROIT LAKE

Location: Becker County
Size: 3,089 acres
Depth: 80 feet (max.)

Background Data: Data is contained in a Minnesota Department of Conservation lake survey conducted in July, 1952, "notes for meeting on eutrophication of lakes of the Pelican River Chain in Becker County, Minnesota" by John Moyle, Minnesota Department of Conservation, 1967.

LAKE MELISSA

Location: Becker County
Size: 1,827 acres
Depth: 37 feet (max.)

Background Data: Data are contained in Minnesota Department of Conservation lake surveys from 1949 and 1968, also Report on the Experimental Removal of Phosphorous from Sewage Effluents with Lime, Detroit Lakes, Minnesota by Minnesota Department of Health, April, 1950.

LAKE SALLIE

Location: Becker County
Size: 1,287 acres
Depth: 55 feet (max.) 19 feet (median)

Background Data: Data are reported in the Report on Preliminary Investigation of the Algal Growths in Lakes in the Vicinity of Detroit Lakes, Minnesota, a report from the Department of Conservation and Minnesota Department of Health, from May, 1948. Three years of creel census was conducted on Lake Sallie, Becker County, by the Minnesota Department of Conservation, 1955. The Minnesota Department of Conservation conducted a lake survey in 1949.

Problem and Source: The primary problem, which has caused concern for more than twenty years in these three lakes, is the excessive growths of nuisance aquatic plants and algae.

There are several factors which contribute to the overabundance of aquatic weeds and algae--

1) Field studies on Lakes Sallie and Melissa show that no thermocline or temperature stratification exists in either lake. This condition allows nutrients to circulate in the lake throughout the summer growing season.

2) There are large areas of the lakes shallower than ten feet which are favorable for rooted aquatic plants.

3) Another factor is the probable addition of nutrients to the lakes from the watershed, both past and present. A study made in the 1940's proved inconclusive in a court case but it is now quite generally agreed that sewage effluent, even from the most improved plants, adds fertility to the receiving waters.

Rehabilitation: A cooperative study financed by the City of Detroit Lakes, the federal government, and the Pelican River Watershed Association has studied municipal sewage inflows, groundwater quality, and feasibility of harvesting rough fish and aquatic plants to reduce nutrients in the lakes.

There has been algae and aquatic weed control on these lakes for many years under permits from the Conservation Department and paid for locally. There has been aquatic weed control or algal control on Sallie in ten out of the eleven years (1956-66) and if control of growths in shallow water is considered, about 16 percent of the area of the lake has been treated in a usual year. Similar figures for the other lakes are four percent for Melissa and 1 percent for Detroit. Both mechanical and chemical measures have been emphasized. Since the shorelines are nearly completely occupied by homes, cottages and resorts, there has also been some shoreline improvement and there is considerable demand for weed-free areas for water recreation.

Even with an active program to minimize all causes of excess fertility, there is no assurance of a rapid and permanent decrease of algae and aquatic plant growth in lakes such as these. Because of the shape of the lake basins and their location in a region of fertile soils, they are ideally suited to the growth of blue-green algae and rooted aquatics. The problem is one of lake and watershed management so that reasonable results are obtained consistent with limitations imposed by natural conditions.

PIKE LAKE

Location: St. Louis County
Size: 508 acres
Depth: 62 feet (max.) 28 feet (median)

Problem and Source: The lake has generally poor water quality and fluctuating water levels.

Rehabilitation: Copper sulfate treatments to control algal blooms have been attempted. The Pike Lake Sanitary District was formed in 1958.

Background Data: The Minnesota Pollution Control Agency Report was issued in 1968.

PRIOR LAKE

Location: Scott County
Size: 620 acres
Depth: 56 feet (max.)

Problem and Source: Excessive algal growths are a problem due to nutrient loading from inadequate soil absorption systems and from nutrient recycling due to rough fish action.

Rehabilitation: Copper sulfate treatment of midsummer algal blooms has been attempted on an irregular basis since 1948.

Background Data: The Minnesota Department of Conservation issued a lake survey report in September, 1948. Additional data is contained in a fish stocking report of 1955, rough fish removal reports from 1957 and 1958, and a Department of Conservation Water Quality Report done in September, 1962.

RICE LAKE

Location: Anoka County
Size: 433 acres
Depth: 5 feet (max.)

Problem and Source: There is a problem with excessive algal and aquatic weed growth plus fluctuating water levels.

Rehabilitation: Aquatic weed and algal control have been undertaken annually by the Minneapolis Water Department.

Background Data: A Minnesota Department of Conservation limnological survey was done in 1937, duck survey in 1955, and lake survey in 1962. Also, a Department investigation of the effect of raising the lake level seven feet in the Rice Creek chain of lakes was conducted in October, 1955.

Comments: Rice Lake is part of the Minneapolis city water supply reservoir system.

RUSH LAKE

Location: Sherburne County
Size: 161 acres
Depth: 7 feet (median)

Problem and Source:	Excess algae in the lake is probably due to excess shoreland development.
Rehabilitation:	Copper sulfate treatments have been made to control algal blooms.
Background Data:	The Minnesota Department of Conservation conducted a lake survey in July, 1955.

SAKATAH LAKE

Location: LeSueur County
Size: 881 acres
Depth: 12 feet (max.)

Problem and Source:	Nutrient sources include sewage treatment plant effluent and agricultural runoff entering the lake via the Cannon River.
Rehabilitation:	Copper sulfate treatments have been undertaken for algal blooms. Rough fish removal has been carried out on an annual basis to prevent control of nutrient recycling.
Background Data:	The Minnesota Pollution Control Agency issued a report in 1970. A Minnesota Department of Conservation Lake Survey was published in 1955.

LAKE SALLIE

(See Pelican River Chain of Lakes)

SHAGAWA LAKE

Location: St. Louis County
Size: 2,639 acres
Depth: 48 feet (max.) 22 feet (median)

Problem and Source: Shagawa Lake has experienced excessive algal growth in one end due to the addition of effluent from the treatment plant serving Ely, Minnesota.

Rehabilitation: Copper sulfate treatments for algae have been made in the past. Future plans include construction of an advanced (tertiary) waste treatment facility at Ely which would return a high quality effluent to the lake.

Background Data: The U. S. Forest Service (Duluth office) is currently studying ways to improve water quality in the lake. The U. S. Environmental Protection Agency has also been conducting studies on the lake for several years and is responsible for the tertiary treatment plant which is being planned.

SHETEK LAKE

Location: Murray County
Size: 3,596 acres
Depth: 10 feet (max.) 5 feet (median)

Problem and Source: Excessive algal blooms plus water level fluctuations and sedimentation are the major concerns.

Rehabilitation: Copper sulfate has been used to control algae and a control dam has been in use to maintain water levels.

Background Data: A study was made of sediment accumulation in Lake Shetek by Charles Collier, District Chief, U. S. Geological Survey, St. Paul, Minnesota, 1970. The Minnesota Department of Conservation, Division of Game and Fish conducted a water quality analysis of Lake Shetek in July, 1969. A report entitled "Lake Shetek and Related Groundwater Conditions," by Morris Eng, Minnesota Department of Conservation was issued in December, 1970.

Comments: The Conservation Department is currently conducting a study of the Lake Shetek problem with money appropriated from the 1969 legislative session. The study report will be completed in about two months.

SISSETON LAKE

(See Fairmont Chain of Lakes)

SPRING LAKE

Location: Scott County
Size: 690 acres
Depth: 38 feet (max.) 13 feet (median)

Problem and Source: Excessive algal growth plus fluctuating water levels are the main concerns.

Rehabilitation: Copper sulfate treatments on an annual basis for twenty years were conducted at a cost of $2,600/year.

Background Data: The Minnesota Department of Conservation conducted lake surveys in 1940, 1948, and 1954.

TETONKA LAKE

Location: LeSueur County
Size: 1,336 acres
Depth: 35 feet (max.)

Problem and Source: Problems with algal blooms are attributed to agricultural runoff into the Cannon River and to nutrient recycling due to rough fish action.

Rehabilitation:	Copper sulfate treatments to control algal blooms and rough fish removal have been conducted on an annual basis.
Background Data:	A Minnesota Pollution Control Agency Report was issued in 1970. The Minnesota Department of Conservation conducted a lake survey in 1955.

MISSOURI

LAKE JACOMO

Location: Jackson County
Size: 970 acres (approx.)
Depth: 38 feet (approx. max.)

Problem and Source: Lake Jacomo is the primary recreational water for the greater Kansas City area. It has over 2,000,000 visitor hours per year. The lake is heavily dissected and drains agricultural lands, some homesites, and a feedlot. There are annual algae blooms and a periodic heavy plankton rain with consequent odor problems and filling of the lake basin.

An intensive study was begun in June, 1970. The lake was previously studied in only cursory fashion and on rare occasions. A brief look at data acquired during the summer indicates that Lake Jacomo is eutrophic. Nitrates and phosphates were always present in detectable quantities. After a spring maximum dominated by diatoms (especially Asterionella) and Cladocera (especially Daphnia pulex) the summer weekly dominants have been as follows: Coelosphaerium, Ceratium hirundinella, Keratella chochlearis (1 June); Mougeotia, Ceratium (8 June), Mougeotia (15 June), Mougeotia (22 June), Apanizomenon flos-aquae, Coelosphaerium (29 June); Apanizomenon, Pediastrum simplex, Spaerocystis Schroeteri (6 July); Aphanizomenon, Ceratium (13 July); Aphanizomenon, Brachionus angularis, Conochilus (20 July); Aphanizomenon (27 July); Synedra delicatissima (3 August); Aphanizomenon, Synedra (10 August); and Aphanizomenon (17 August).

Rehabilitation: There have been no previous treatments. Recommendations include:

1) Removal of the feedlot; the lot was not used extensively during the summer of 1970.
2) Removal of homesite septic tank drainage by installing sanitary sewers.
3) Eradication program for pondweeds that grow in the shallows during the summer.
4) Dredging of certain lake areas to deepen it and to remove sediments. By July the dissolved

oxygen concentration was often zero below a depth of 20 feet. Dredging could be beneficial or detrimental; more study is needed.

Background Data: The results of this study (weekly sampling at 16 stations during the summer of 1970), continued sampling throughout the autumn, winter, and spring (8 stations twice monthly), and proposed studies during the summer of 1971 (the benthos, bacteria) will provide baseline information to document changes due to lake rehabilitation.

MONTANA

GEORGETOWN LAKE

Location:	Anaconda, Montana (near)
Size:	2,800 acres
Depth:	50 feet (max.)

Problem and Source: The lake has experienced occasional fish kills due to oxygen depletion during periods of ice cover. Also, there are extensive growths of vegetation in some areas. There is concern that the problem may be greater in the future.

Rehabilitation: Aeration through short lengths of tubing during winter has been tried by the Fish and Game Department with unknown effectiveness. Proposed rehabilitation might be removal of some of the rooted vegetation.

Background Data: Very little background data is available at present. The U. S. Forest Service is planning to obtain some chemical and biological information through a grant to one of the state universities.

Comments: Lake level was raised to provide storage for industrial-municipal use and power generation.

This is probably the best natural fishery in the state.

There is very little residential development around the lake. The surrounding land is owned primarily by the Forest Service and Anaconda.

NEBRASKA

SALT VALLEY RESERVOIRS

BRANCHED OAK

Location:	17 miles northwest of Lincoln
Size:	1,800 acres
Depth:	33 feet (max.)

PAWNEE

Location:	12 miles northwest of Lincoln
Size:	740 acres
Depth:	33 feet (max.)

STAGECOACH

Location:	Lancaster County, 17 miles south of Lincoln
Size:	170 acres
Depth:	23-26 feet (max.)

Problem and Source: These lakes experience frequent blooms of blue-green algae, and have extensive areas of rooted aquatic plants (extending in places to depths of five meters). These conditions interfere with water contact sports, picknicking, and fishing. The primary source of the problem is agricultural runoff.

Rehabilitation: Remedial action would most profitably be directed to impeding light penetration in the reservoirs. Temporary improvement in and around swimming areas, boat docks, and in certain fishing areas could be achieved through a mowing program for plant removal.

Background Data: There have been three years of study. Relatively complete information exists on 1) water chemistry, 2) standing crops of algae, 3) species composition of algae, 4) Carbon-14 productivities, 5) standing crop of benthos, 6) composition of the benthos, 7) standing crop of the zooplankton and, 8) composition of the zooplankton.

NEW HAMPSHIRE

KEZAR LAKE

Location: North Sutton
Size: 180 acres
Depth: 30 feet (max.)

Problem and Source: The water quality in Kezar Lake has deteriorated significantly because of sewage effluent entering via the lake's major tributary.

Rehabilitation: The only treatment attempted before the summer of 1969 was the use of copper sulfate to control blue-green algal blooms. During the summer of 1967, copper sulfate treatment resulted in a six-ton fish kill. Analysis of the algae in the water after the fish kill revealed that the practically pure culture of Aphanizomenon flos-aquae present in the lake was a toxic form. Since then copper sulfate has not been used. Instead, compressed air is being pumped to the deep test area of the lake via plastic pipes. The bubbles released through the perforated pipe on the lake bottom has resulted in preventing the stratification of algae, and has thus equalized the chemical and physical characteristics from top to bottom in the lake.

Background Data: A graduate student began work on this lake in the spring of 1968, gathering information on many physical, chemical, and biological aspects of the lake.

The compressed air pumps were turned on in July, and data gathering continued until ice formation. The same data collection began shortly after ice-out in the spring of 1969 and continued until ice formation in the fall. This data is being processed now. It is believed to be adequate to document a change if rehabilitation were undertaken.

Comments: The New Hampshire Water Supply and Pollution Control Commission cooperated in this research effort. In addition, they stimulated the construction of a sewage disposal plant which hopefully will strip nutrients from the sewage effluent before it enters the lake.

WINNISQUAM LAKE

Location: Tilton and Laconia
Size: 4,300 acres
Depth: 165 feet (max.)

Problem and Source: This lake has received the domestic sewage from the city of Laconia, New Hampshire since 1945. At present, the effluent amounts to from 2 to 6 m.g.d. The water quality has deteriorated in much of the lake and is lower at the outlet end of the lake than it is at the other end of the lake.

Rehabilitation: This lake has been treated periodically with copper sulfate since about 1960 to control blue-green algal blooms.

Diversion of the sewage is possible, but this would direct it into the Merrimack River which is already highly polluted. It would appear that nutrient stripping might be a possible solution.

Background Data: Two summers of intensive data collection include primary productivity, chlorophyll analysis, algal enumeration and speciation, light penetration, conductivity measurements, temperature, carbon dioxide, oxygen, methylorange alkalinity, pH, and some zooplankton analysis.

It is believed that sufficient data has been collected by investigations plus the information compiled over the years by the New Hampshire Water Supply and Pollution Control Commission to give a "before" picture if rehabilitation is attempted.

NEW JERSEY

ALLENTOWN POND

Location: Allentown
Size:
Depth:

Problem and Source:	There is a heavy growth of attached aquatic vegetation over part of the lake.
Rehabilitation:	No known previous corrective treatment has been attempted. Partial dredging of the lake bottom is recommended.
Background Data:	Very limited background data are available through New Jersey Division of Fish, Game and Shell Fisheries; not adequate to document change.

ATSION POND

Location: Atsion
Size: 93 acres
Depth:

Problem and Source:	The lake has dense and widespread attached aquatic vegetation.
Rehabilitation:	No known previous corrective treatment has been attempted. Partial dredging of the lake bottom is recommended.
Background Data:	Background data are available in files of New Jersey Division of Fish, Game and Shell Fisheries; adequacy for documenting change is questionable.

BUDD LAKE

Location:	Budd Lake
Size:	376 acres
Depth:	14 feet

Problem and Source:	The lake is undergoing eutrophication at a rapid rate, which is manifest in dense attached aquatic vegetation.
Rehabilitation:	Chemicals have been applied in the past, though none are presently being used. Partial to complete dredging together with removal of nutrient contributions is recommended for more complete renewal.
Background Data:	The data are available in files of the New Jersey Division of Fish, Game and Shell Fisheries; adequacy to document a change is questionable.

CARNEGIE

Location:	Princeton
Size:	237 acres
Depth:	9 feet (max.)

Problem and Source:	Severe sedimentation of soil materials and organic matter are filling in the lake. Heavy growths of attached aquatic vegetation are an added nuisance.
Rehabilitation:	Partial herbicide treatment is made annually. Partial to complete dredging together with removal of nutrient contributions is recommended.
Background Data:	Same as above; additional data has been collected by Princeton University; probably adequate to document change.

COLLIERS MILL POND

Location: Colliers Mills
Size: 17 acres
Depth: 5 feet (max.)

Problem and Source: The lake has dense and widespread attached aquatic vegetation.

Rehabilitation: Herbicide control is practiced annually or biannually. Complete dredging is recommended for more permanent control.

Background Data: Data are available from the New Jersey Division of Fish, Game and Shellfisheries files; possibly adequate to document change.

COMO LAKE

Location: Belmar
Size: 34 acres
Depth: 13 feet (max.)

Problem and Source: The primary problem is dense and widespread attached aquatic vegetation on the lake bottom.

Rehabilitation: Chemical weed control has been practiced. Partial dredging is recommended for more permanent control.

Background Data: Data are available from the New Jersey Division of Fish, Game and Shell Fisheries files; adequacy to document change is questionable.

DEAL LAKE

Location: Asbury Park
Size: 158 acres
Depth: 10 feet (max.)

Problem and Source: The lake has localized areas of heavy sediment accumulation and widespread attached aquatic vegetation.

Rehabilitation: Some dredging and chemical aquatic vegetation control has been tried in the past. Partial dredging is recommended for the future.

Background Data: Same as above; Possibly adequate to document change.

DUHERNAL LAKE

Location: Old Bridge
Size: 93 acres
Depth: 10 feet (max.)

Problem and Source: Dense and widespread attached aquatic vegetation are a nuisance in the lake.

Rehabilitation: No known previous corrective treatment have been tried. Possibly complete dredging and removal of nutrient sources would improve the lake.

Background Data: Same as above; adequacy to document change is questionable.

GREENWOOD LAKE

Location: Hewitt
Size: 983 acres
Depth: 33 feet (max.)

Problem and Source: Dense and widespread attached aquatic vegetation cause a problem in the lake.

Rehabilitation: Herbicidal control has been practiced annually or biannually in the past. Partial dredging and removal of nutrient sources is recommended for the future.

Background Data: Same as above; adequacy to document change is questionable.

GROVERS MILL POND

Location: Princeton
Size: 28 acres
Depth: 6 feet (max.)

Problem and Source: Sedimentation and dense and widespread attached aquatic vegetation are the major concerns in this lake.

Rehabilitation: Herbicides have been applied in the past; complete dredging and control of upstream sediment sources is recommended for future control.

Background Data: Same as above; adequacy to document change is questionable.

LAKE HOPATCONG

Location: Hopatcong
Size: 2,685 acres
Depth: 58 feet (max.)

Problem and Source: The lake bottom has extensive areas of dense attached aquatic vegetation.

Rehabilitation: Limited success has been achieved with annual chemical aquatic vegetation control (some areas not treatable because of proximity to potable water intakes); complete dredging is recommended as a more permanent solution.

Background Data: Same as above; possibly adequate to document change.

IMLAYSTOWN LAKE

Location: Imlaystown
Size: 28 acres
Depth: 10 feet (max.)

Problem and Source: The lake has received heavy accumulations of soil sediments. Shallow water and widespread and dense attached aquatic vegetation are also problems.

Rehabilitation: Chemical weed control has been attempted in the past with limited success and is not practical to continue. Complete dredging is recommended.

Background Data: Same as above; possibly adequate to document change.

LAKE MUSCONETCONG

Location: Netcong
Size: 300 acres
Depth: 7 feet (max.)

Problem and Source: There are heavy growths of attached aquatic vegetation over almost the entire lake bottom.

Rehabilitation: Partial annual chemical aquatic vegetation control has been practiced in the past. Recommended future rehabilitation includes diking part of the existing lake basin so as to provide spoil areas and embarking on a dredging program with a twenty foot depth the objective.

Background Data: Same as above; possibly adequate to document change.

NEWTON LAKE

Location: Haddon
Size: 198 acres
Depth:

Problem and Source: There has been a rapid accumulation of soil sediment due to upstream land development.

Rehabilitation: No known previous treatment has been attempted. Partial dredging following correction of the problem at the source is recommended.

Background Data: Same as above; adequacy to document change is questionable.

LAKE PARSIPPANY

Location: Lake Parsippany
Size: 160 acres
Depth: 5 feet (average)

Problem and Source: Severe eutrophication is manifest in dense algal growths. Also, the lake has insufficient flow for its area.

Rehabilitation: Chemical algae control has been attempted in the past. Recommended rehabilitation includes setting aside part of the lake to receive spoil and dredge, making the area more commensurate with the available water supply.

Background Data: Same as above; also, the Lake Parsippany Association has additional data; adequacy to document change is questionable.

PAULINSKILL LAKE

Location: Stillwater
Size: 157 acres
Depth: 14 feet (max.)

Problem and Source: Nutrients stimulate a dense algal growth in the lake.

Rehabilitation: No known previous treatment has been attempted.

Background Data: Same as above; not adequate to document change.

PEDDIE LAKE

Location: Hightstown
Size:
Depth:

Problem and Source: Sedimentation and dense and widespread attached aquatic vegetation are problems in this lake.

Rehabilitation: Complete dredging plus control of upstream contributions to the problem are recommended.

Background Data: Limited information is available from the New Jersey Division of Fish, Game and Shell Fisheries files; not adequate to document change.

POMPTON LAKES

Location: Pompton Lakes
Size: 204 acres
Depth: 19 feet (max.)

Problem and Source: Sedimentation and attached aquatic vegetation are the primary concerns in this lake.

Rehabilitation: Occasional herbicidal control has been applied in the past. Partial dredging and removal of nutrient sources is recommended.

Background Data: Same as above; adequacy to document change is questionable.

ROWANDS POND

Location: Clementon
Size: 2 acres
Depth: 6 feet (max.)

Problem and Source: The lake is experiencing encroaching heavy aquatic vegetation due to shallowing depths.

Rehabilitation: No known previous treatment has been tried. Partial dredging is recommended.

Background Data: Same as above; adequacy to document change is questionable.

SAXTON LAKE

Location: Hackettstown
Size: 60 acres
Depth: 8 feet (max.)

Problem and Source: There is a heavy growth of attached aquatic vegetation over almost the entire lake bottom.

Rehabilitation: Chemical aquatic vegetation control has been undertaken approximately biannually. Complete dredging is recommended.

Background Data: Same as above; adequacy to document change is questionable.

SHEPHERDS LAKE

Location: Ringwood
Size: 72 acres
Depth: 36 feet (max.)

Problem and Source: The lake has dense and widespread attached aquatic vegetation.

Rehabilitation: Partial chemical treatment has been practiced annually. Dredging of portions of the lake bottom is recommended.

Background Data: Same as above; adequacy to document change is questionable.

LAKE SOLITUDE

Location: Highbridge
Size: 19 acres
Depth: 12 feet (max.)

Problem and Source: Severe sedimentation and attached aquatic vegetation are a problem in the lake.

Rehabilitation: Complete dredging and control of upstream contributors to the problem is recommended.

Background Data: Same as above; not adequate to document change.

SPEEDWELL LAKE

Location: Morristown
Size:
Depth:

Problem and Source: Severe sedimentation is the major concern in this lake.

Rehabilitation: No known previous treatments have been attempted. Partial to complete dredging with appropriate upstream sediment control is recommended.

Background Data: Same as above; not adequate to document change.

SQUARE CIRCLE LAKE

Location: Gibbsboro
Size:
Depth:

Problem and Source: The lake has suffered frequent fishkills due to flushing of toxicants from an unused landfill site during heavy precipitation.

Rehabilitation: Liming in an attempt to stabilize heavy metals has been practiced in the past. Removal of the landfill is recommended.

Background Data: Same as above; adequacy to document change is questionable.

SUNSET LAKE

Location: Asbury Park
Size:
Depth:

Problem and Source: Accumulated organic materials cause severe annual water quality inadequacies.

Rehabilitation:	No known previous corrective treatments have been attempted. Complete dredging is recommended.
Background Data:	Same as above; possibly adequate to document change.

SUNSET LAKE

Location: Bridgeton
Size: 179 acres
Depth: 15 feet (max.)

Problem and Source:	There is a severe density of unicellular algae in the lake.
Rehabilitation:	There have been no previous corrective treatments. Complete dredging following identification and removal of nutrient sources is recommended.
Background Data:	Same as above; also, additional information is available in "Environmental Quality": very likely adequate to document change.

TAKANASEE LAKES (UPPER AND LOWER)

Location: Long Branch
Size:
Depth:

Problem and Source:	The lake contains heavy and widespread attached aquatic vegetation.
Rehabilitation:	There have been no known previous corrective treatments; complete dredging is recommended.
Background Data:	Same as above; also, additional information is available from the Bureau of Navigation; adequacy to document change is questionable.

TOPENEMUS LAKE

Location: Freehold
Size: 15 acres
Depth: 6 feet (max.)

Problem and Source: Dense and widespread attached aquatic vegetation are a problem in the lake.

Rehabilitation: Complete dredging and control of upstream contributions to the problem are recommended.

Background Data: Same as above; very limited; not adequate to document change.

VERONA PARK LAKE

Location: Verona
Size: 13 acres
Depth: 10 feet (max.)

Problem and Source: Accumulated organic matter and nutrients are the principal concern in this lake.

Rehabilitation: No known previous corrective treatments have been attempted. Shallow dredging over most of the basin and removal of sources of contaminants are recommended.

Background Data: Same as above; adequacy to document change is questionable.

WATERLOO POND

Location: Waterloo
Size: 48 acres
Depth: 6 feet (max.)

Problem and Source: There is a heavy growth of attached aquatic vegetation over almost the entire lake bottom.

Rehabilitation: Chemical aquatic vegetation control is undertaken approximately biannually. Complete dredging is recommended as a more permanent solution.

Background Data: Same as above; adequacy to document change is questionable.

WEEQUAHIC PARK LAKE

Location: Newark
Size: 80 acres
Depth: 7 feet (max.)

Problem and Source: The lake is undergoing rapid eutrophication with conditions almost annually becoming critical for fish or causing fish kills.

Rehabilitation: No known previous corrective treatments have been tried. Checking of nutrient sources and dredging to remove accumulated nutrients are recommended.

Background Data: Same as above; possibly adequate to document change.

WESTONS MILL POND

Location: New Brunswick
Size: 92 acres
Depth: 18 feet (max.)

Problem and Source: The lake has dense and widespread attached aquatic vegetation.

Rehabilitation: There have been no known previous corrective treatments. Complete dredging and control of upstream contributions to the problem are recommended.

Background Data: Same as above; not adequate to document change.

Problem and Source:	There is a heavy growth of attached aquatic vegetation over almost the entire lake bottom.
Rehabilitation:	Chemical aquatic vegetation control is undertaken approximately biannually. Complete dredging is recommended as a more permanent solution.
Background Data:	Same as above; adequacy to document change is questionable.

WEEQUAHIC PARK LAKE

Location:	Newark
Size:	80 acres
Depth:	7 feet (max.)

Problem and Source:	The lake is undergoing rapid eutrophication with conditions almost annually becoming critical for fish or causing fish kills.
Rehabilitation:	No known previous corrective treatments have been tried. Checking of nutrient sources and dredging to remove accumulated nutrients are recommended.
Background Data:	Same as above; possibly adequate to document change.

WESTONS MILL POND

Location:	New Brunswick
Size:	92 acres
Depth:	18 feet (max.)

Problem and Source:	The lake has dense and widespread attached aquatic vegetation.
Rehabilitation:	There have been no known previous corrective treatments. Complete dredging and control of upstream contributions to the problem are recommended.
Background Data:	Same as above; not adequate to document change.

NEW YORK

CAYUGA LAKE

Location: Cayuga County (west central New York state)
Size: 42,496 acres
Depth: 435 feet (max.) 179 feet (mean)

Problem and Source: This lake has shown some signs of increasing algal productivity, particularly in the blue-green group. Shoreline residents have also expressed the opinion that rooted vegetation has become more of a problem in recent years but this change is undocumented. The amounts of nutrients entering the lake have steadily increased along with population growth in the area and an effort is currently being made to establish a baseline describing the relative magnitudes of the sources.

Rehabilitation: No corrective treatments have been attempted.

Remedial action may very well include tertiary treatment of wastes from the city of Ithaca and improved secondary and possibly tertiary treatment for some of the small municipalities around the lake's periphery. Further research is needed in order to ascertain whether or not phosphorus is truly a limiting factor to production in the lake. As is the case in all of the Finger Lakes, waters are naturally rich in nitrogen and there appears to be no possibility of eutrophication control by limiting the input of this nutrient.

Background Data: Cayuga Lake was first studied by Birge and Juday in the early 1900's. Its fishery has been intensively studied since the late 40's and is currently under close management control. Other limnological studies were done in the 1930's and 1950's. None of these were comprehensive nor did any prior to the decade of the 60's include measurement of nutrients.

During 1968-69 an intensive one-year study, generated by the proposed construction of a nuclear fueled, electric generating station, was performed and this included much of the information needed to develop a tentative management strategy. General limnological survey work is continuing at present on a much reduced scale.

Insufficient data currently exist to determine small scale trends in change but should be sufficient to document any extensive shifts in water quality.

CONESUS LAKE

Location:	Livingston County (approx. 25 miles south of Rochester)
Size:	3,328 acres
Depth:	59 feet (max.)

Problem and Source: This lake is plagued with extensive growths of rooted aquatic plants and also supports substantial blooms of algae. Sources of nutrients include: 1) municipal effluents; 2) septic tank seepage; 3) industrial wastes (chicken processing plant).

Rehabilitation: No corrective treatments have been attempted.

Remedial action should probably include improved sewage treatment for a small town at the inlet end of the lake and control of effluents from cottages around the lake.

Background Data: A fairly extensive and quantitative study of the rooted aquatics in Conesus Lake has been done. Rehabilitation should result in documentable changes.

Comments: The lake is ringed with cottages. The main problem with rehabilitation is that there are a large number of dispersed nutrient sources to curtail.

LAKE GEORGE

Location: Borders Warren, Washington, and Essex Counties
outlet at 43°50'13"N Lat., 73°25'50"W Long.
Size: 28,200 acres
Depth: 187 feet (max.)

Problem and Source: Lake George is a large, relatively oligotrophic body of water. Overall water quality is excellent; however, the southern basin is receiving more of man's pollutional inputs in this more heavily populated region. There have been some reports of algal growths in isolated bays and at outlets of brooks and streams.

Background Data: Extensive chemical and diatom data are available from 1968. Earlier figures are sketchy. The lake is an IBP study site which should generate extensive background data.

LAKE GREENWOOD

Location: Town of Lake Greenwood; southeastern New York/New Jersey
Size: 1,920 acres
Depth: 35 feet (max.)   7 feet (mean)

Problem and Source: Weed growths, algal blooms, and silt deposits are a problem in this lake. Sources of nutrients are septic tank effluent from houses surrounding the lake and some raw sewage discharges.

Rehabilitation: A collection system for lakeside housing development is needed to divert the present effluents entering the lake.

Background Data: Little data are available, some coliform counts only.

ONEIDA LAKE

Location: Oneida County (approx. 10 miles northeast of Syracuse)
Size: 51,200 acres
Depth: 55 feet (max.)

Problem and Source: Oneida Lake is a large eutrophic body of water. It supports excellent fish populations, but suffers from periodic fish kills. The algal growths are quite extensive and have a long history, dating back several hundreds of years. In spite of its eutrophic nature, it receives heavy usage, and this has further accelerated the natural aging process. Algal blooms have become generally more frequent and more intense.

Rehabilitation: Fairly recent installations of sewage treatment facilities at some of the tributaries has reduced the nutrient loadings on the lake, and this has reportedly reduced the frequency and intensity of nuisance conditions. This recently alleged improvement has not been documented, however.

Background Data: A fairly extensive one-year limnological study of the lake was done during 1969-70. The fisheries of the lake have been studied since the mid-fifties. Background data are sufficient to document a substantive change if rehabilitation were undertaken.

ONONDAGA LAKE

Location: Onondaga County
Size: 2,890 acres
Depth: 67 feet

Problem and Source: The lake receives heavy municipal contributions and discharges from almost 140 major industries.

Rehabilitation: Most previous studies have involved engineering feasible studies for this unusual, relatively saline lake.

Background Data:	The most complete report concerning Onondaga Lake is being prepared at this time through funds from the F.W.Q.A. to an engineering firm in Syracuse, New York. This would be the most complete source of information available for Onondaga and one of the most intensive studies carried out on a New York lake.

OWASCO LAKE

Location: Cayuga County (approx. 20 miles southwest of Syracuse)
Size: 6,592 acres
Depth: 177 feet (max.) 96 feet (mean)

Problem and Source:	This lake appears to be undergoing fairly rapid eutrophication at present. Algal blooms are commonplace, although still of relatively low intensity compared with many more highly eutrophic bodies of water.
Rehabilitation:	No corrective treatments have been undertaken. Remedial action probably would center on the exclusion of nutrients from the lake basin.
Background Data:	Background data on this lake is very sparse and certainly insufficient to document changes if rehabilitation were undertaken.

SARATOGA LAKE

Location: Within Saratoga County
outlet at 43°06'10"N Lat., 73°38'12"W Long.
Size: 4,339 acres
Depth: 96 feet (max.)

Problem and Source:	Saratoga Lake is an intermediate-sized and mesotrophic-eutrophic body of water. This lake supports excellent fish populations, but the algal growths have become quite intense relative to conditions of perhaps five to ten years ago. The major source of nutrient

inputs is from Kayderosseras Creek which transports the treated sewage effluent from nearby urban areas. There is also a heavy concentration of cottage development along the shores of the lake, and septic tank effluent is a significant source for nutrients. It appears that the relatively recent transition in this lake has resulted in decreased swimming and other primary contact recreational activities. There have also been reports of recent fish-kills, the cause of which has not been determined.

Rehabilitation: It is planned that the major source of nutrients, namely the treated sewage effluents which presently enter Kayderosseras Creek, be diverted from the creek. It is anticipated that removal of this major pollutional source, along with other protective measures, will serve to reduce the man-induced rate of eutrophy in this ecosystem will result.

Background Data: Lake survey data including chemistry, weed growth and fish life have been collected by the Bureau of Fish, New York State Department of Environmental Conservation.

SCHROON LAKE

Location: Essex and Warren Counties
outlet at 43°43'40"N, 73°48'42"W
Size: 4,230 acres
Depth: 152 feet (max.)

Problem and Source: Overall quality in this lake is comparable to Lake George. Algal blooms have been reported from some isolated bays. The major source of pollution is an adjacent municipality discharging effluent to the lake.

Rehabilitation: The village is planning to install sewer lines and adequate treatment facilities in the near future.

Background Data: Lake survey data including chemistry, weed growth and fish life have been collected by the Bureau of Fish, New York State Department of Environmental Conservation.

SENECA LAKE

Location: Seneca County (west central New York state)
Size: 43,328 acres
Depth: 290 feet (mean) 618 feet (max.)

Problem and Source: Although there is little quantitative documentation, Seneca Lake does have a persistent problem with extensive and dense growths of aquatic milfoil at its northern end.

Rehabilitation: Corrective treatments have included attempts to mechanically cut weed-free chennels in one area of the lake. It is thought that a small amount of work has also been done using aquatic herbicides.

Remedial action needed probably centers around the mechanical or chemical control of the milfoil beds.

Background Data: Background data is sparse although some aerial photographic mapping of weed beds has been done. This information probably exists for at least a two-year period. If rehabilitation is undertaken, improvement should be readily apparent without the need of a highly quantitative description.

NORTH DAKOTA

LAKE ASHTABULA

Location: Barnes County (8 miles northwest of Valley City)
Size: 890 acres (normal pool)
Depth: 50 feet (max.) 13 feet (mean) (normal pool)

Problem and Source: Lake Ashtabula is a 20-year old reservoir located on the Sheyenne River. The lake is very productive and supports intense blooms of largely blue-green algae from June or July until freeze-up in November or December. The blooms are dominated both in numbers and in volume by Aphanizomenon holsaticum which create large surface scums and objectionable odors when they are blown to shore and decompose. A dense band of submergent vegetation of predominantly Potomogeton species is found in a 10 to 20 meter wide band along the shoreline of the reservoir which makes shoreline activities such as swimming and fishing difficult.

The major causes of the dense growths of algae and rooted aquatics are excess nutrients entering the lake from the watershed, which is predominantly agricultural.

An additional management problem will exist when Lake Ashtabula receives irrigation-return flows from the Garrison Diversion Project scheduled for completion is the late 1970's. The irrigation waters entering the lake from the Sheyenne River are expected to contain about two times the amounts of dissolved solids present now.

Rehabilitation: No corrective treatments have been attempted to date.

Suggestions for partial correction of the problem include:

1) reduction of nutrient input from the watershed by controlling point source introductions of animal wastes from feedlots and from sewage lagoons of cities located in the watershed.

2) control of water levels in the reservoir to help flush out nutrient-rich water present during late winter months.

3) removal of fish as a possible beneficiary affect upon changing the composition of algae from objectionable to more acceptable forms (Peterka and Knutson, 1970).

Background Data: Studies have been conducted in Lake Ashtabula relating to water quality, benthic organisms, phytoplankton and zooplankton production and fish growth (Peterka and Reid, 1969; and Peterka, 1970), and the lake has probably received more detailed studies than any other reservoir in the state in which problems and corrections of eutrophication have been approved.

The State Game and Fish Department has collected data on the relative abundance of fish species and the age and growth of several species of fish in the lake.

The North Dakota Geological Survey is conducting a study to determine rates of sediment accumulation in the lake and the U. S. Corps of Engineers is investigating methods of controlling algal blooms.

JAMESTOWN RESERVOIR

Location: James River (north of Jamestown)
Size:
Depth:

Problem and Source: This is a seventeen-year old reservoir which appears to have problems similar to Lake Ashtabula.

Rehabilitation: No attempts have been made or proposed.

Background Data: No data has been collected or background studies conducted to date on this reservoir.

SPIRITWOOD LAKE

Location: (17 miles northwest of Jamestown)
Size: 704 acres
Depth: 48 feet (max.) 26 feet (average)

Problem and Source: During the last six or seven years, the lake has developed large blooms of blue-green algae which have caused considerable concern to persons interested in maintaining the lake's aesthetic and recreational qualities.

Preliminary data indicate that sufficient nitrates and soluable phsophates enter the lake during spring runoff to cause objectionable algal blooms. The entrance of ground water is a major source of water for the lake and an analysis of nutrient budgets will help determine the feasibility of corrective measures.

Rehabilitation: No corrective measures have been attempted, although chemical herbicides are being considered for use in 1971 by the Spiritwood Lake Owners Association.

Background Data: The basic limnology and morphology of the lake were described by Comita and Wolf (1967) and the lake is currently receiving study by Peterka (OWRR-B-001) for the purpose of recommending practical solutions for controlling algal blooms.

Comments: The lake is used for sport fishing, swimming and boating, and has approximately 65 summer cottages along its shores.

OHIO

LAKE ALMA

Location:
Size: 73 acres
Depth: 9.7 feet (average)

Problem and Source: This lake receives acid mine drainage.

Rehabilitation: No information.

Background Data: No information.

BUCKEYE LAKE

Location: Perry, Licking, and Fairfield Counties, 30 miles east of Columbus
Size: 3,800 acres
Depth: 16 feet (max.) approx.

Problem: Almost continuous dredging operations are required to maintain satisfactory depth in the lake.

Rehabilitation: No information.

Background Data: No information.

DEER CREEK RESERVOIR

Location: Stark County, 3 miles north of Alliance
Size: 313 acres
Depth: 20 feet (max.) approx.

Problem and Source: The problem in this lake is colloidal clay suspension.

Rehabilitation: No information.

Background Data: No information.

HOLIDAY LAKE

Location:
Size: 208 acres
Depth: 30-40 feet (max.) 15 feet (average)

Problem and Source:	Holiday Lake is an impoundment formed in 1966. It already experiences summer problems with algae and aquatic weed growth.
Rehabilitation:	The lake receives the treated sewage effluent from the town of Willard, about 6 miles up the river from Holiday Lake. Oil spills from a railroad crossing above the lake also cause periodic problems in the lake.
Rehabilitation:	Copper sulfate for aquatic vegetation and algae has been applied. Lake level manipulation was planned for the winter of 1970-71.
Background Data:	Some water samples were taken between August, 1970, and October, 1970.
Comments:	The land adjacent to the lake will be undergoing extensive development in the next few years, probably with septic tank facilities for water disposal.

LAKE HOPE

Location: Vinton County, Brown Township
Size: 120 acres
Depth: 20 feet (max.) approx.

Problem and Source:	This lake receives acid mine drainage.
Rehabilitation:	No information.
Background Data:	No information.

INDIAN LAKE

Location: Logan County
Size: 5,800 acres
Depth:

Problem and Source: Almost continuous dredging operations are required on this lake to maintain satisfactory depths.

Rehabilitation: No information.

Background Data: No information.

JACKSON LAKE

Location: Jackson County, Jefferson Township
Size: 242 acres
Depth: 10 feet (max.)

Problem and Source: Mine acids drain into this lake causing problems. In addition, excessive vegetation is a nuisance in shallow areas.

Rehabilitation: No information.

Background Data: No information.

LAKE LORAMIE

Location: Shelby and Auglaize Counties
Size: 1,500 acres
Depth:

Problem and Source: Almost continuous dredging operations are required on this lake to maintain satisfactory depths.

Rehabilitation: No information.

Background Data: No information.

OXBOW LAKE

Location: Defiance County, Tiffin Township
Size: 36 acres
Depth:

Problem and Source: Excessive rooted aquatic vegetation is a nuisance in this lake. There is also a problem with colloidal clay suspension.

Rehabilitation: No information.

Background Data: No information.

PORTAGE LAKES

Location: Summit County, Franklin, Green, and Coventry Townships
Size: 1,651 acres
Depth: 50 feet (max.)

Problem and Source: Almost continuous dredging operations are required in these lakes to maintain satisfactory depths.

Rehabilitation: No information.

Background Data: No information.

LAKE ST. MARYS

Location: Mercer and Auglaize Counties
Size: 11,000 acres
Depth: 10 feet (max.)

Problem and Source: Almost continuous dredging operations are required on this lake to maintain satisfactory depths.

Rehabilitation: No information.

Background Data: No information.

OKLAHOMA

BOOMER LAKE

Location:	North-central Oklahoma
Size:	255 acres
Depth:	10 feet (mean)

Problem and Source: Fecal enterococci derived from septic tank drainage has placed the lake off limits to swimming. A municipal beach and swimming area had to be abandoned because state health officials considered the fecal bacteria to be too high for contact sports. The lake also has intense clay turbidity which apparently favors development of thermophilic blue-green algae, and the lake received condenser discharge of heated water from the municipal power plant. Expansion of residential areas around the lake has increased the problem of storm runoff from city streets.

Rehabilitation: The city sewer line has been extended to cover most residential areas immediately adjacent to the lake but all suburban , semi-rural residences outside of the city limits still use septic tanks. Clearing is favored as a means to increase water quality and reduce problems with blue-green algae.

Background Data: The State Department of Public Health issues reports on reservoir water quality. Studies on benthic microinvertebrates and physiochemical conditions were described in the form of an M. S. thesis from Oklahoma State University. Age and growth studies have been investigated for several fishes.

LAKE CARL BLACKWELL

Location:	North-central Oklahoma
Size:	2,700 acres
Depth:	9.6 feet (mean)

Problem and Source:	Intense clay turbidity apparently favors development of thermophilic blue-green algae which can float or fix to substrates near the surface between June and September. The lake is an important source of water for the City of Stillwater. Taste and odor problems become acute during the summer. The sources of nutrients to support algae blooms include the septic system of a resort, influents from pastured land and fertilized fields in the watershed and in situ nitrogen fixation.
Rehabilitation:	No correction measures have been taken. One strategy might be to facilitate clearing so as to favor aquatic plants other than blue-green algae. Diversion of resort sewage below the lake might be another step.
Background Data:	Studies of algae sediment cycling, community respiration and nitrogen cycling have been published or will be published shortly. An interdisciplinary group at Oklahoma State University is preparing a proposal to develop an ecological model of the lake.

FOSS RESERVOIR

Location:	Custer County
Size:	8,800 acres
Depth:	

Problem and Source:	The water in this reservoir has deteriorated in quality to the extent that it can no longer be used as a municipal or industrial water supply. The problem is one which is common in the western U.S., excessive dissolved solids, and results when the annual average lake evaporation exceeds the total annual average precipitation.
Rehabilitation:	A hearing was held in August, 1967, before the Subcommittee on Water and Power Resources, U.S. Senate, to decide whether funds should be authorized for construction of a $2 million, 3 m.g.d. electrodialysis desalination plant. This action was required to provide suitable quality water for municipal and industrial use from Foss Reservoir.
Background Data:	Some data are on file with the Bureau of Reclamation.

GRAND LAKE

Location:	Northeastern Oklahoma 36°30"N.Lat. 95°0"W.Long.
Size:	59,000 acres
Depth:	25 feet (average)

Problem and Source: The lake is undergoing accelerated eutrophication due to large quantities of nitrogen and phosphorus entering the lake. The source of these nutrients include: 1) feed lots in Kansas, 2) a poultry boiler production in southwestern Missouri, 3) municipal effluents from cities in Oklahoma, Kansas, Missouri, and Arkansas, 4) and septic tank drainage from cottages and resorts around the lake.

Rehabilitation: No corrective treatments have been undertaken. Efforts have been made to provide temporary holding impoundments for feed lot runoff, and to get pleasure craft operators to install sewage holding facilities on board for later removal at pump-out facilities.

Remedial action that might be taken would involve: 1) connecting many or all of the septic tanks to a municipal type sewage treatment facility, and either the diversion of the effluent from this facility into some other drainage, or installation of a tertiary treatment facility, 2) construction of appropriate diversion or impoundment of animal wastes in Kansas, Missouri, and Oklahoma, 3) enforce laws prohibiting disposal of human wastes from house boats and other forms of pleasure craft.

Background Data: There is a detailed report on water quality of Grand Lake which is reportedly available from the State Department of Health, Oklahoma City.

OREGON

DEVILS LAKE

Location: Town of Lincoln City, in Lincoln County
Size: 685 acres
Depth: 20 feet (max.)

Problem and Source: Nuisance algal growth and dense emergent weeds in littoral areas have stimulated local citizen concern. Water has been ruled unsafe for contact uses by State health authorities. Domestic wastes from riparian sources has accelerated the eutrophication.

Rehabilitation: Though considerable discussion has taken place, no direct corrective actions have been initiated. A waste collection system is a possible solution.

Background Data: There are considerable data available from the Oregon Department of Environmental Quality, Oregon State Game Commission and Oregon State University.

ODELL LAKE

Location: Near Willamette Pass, Klamath County
Size: 3,600 acres
Depth: 283 feet (max.) 135 feet (mean)

Problem and Source: Algal blooms have only become visibly apparent in the last few years. The problem is not serious as yet but the rate of change is alarming. Increased use from recreationists has taken place. Summer homes, public camp grounds, boaters and fishermen are the nutrient sources.

Rehabilitation: No program has been discussed but here is a case where planning and action now could save costly reclamation later.

Background Data: The Oregon Game Commission and Oregon State University have sufficient limnological data to document the past and present conditions.

UPPER KLAMATH LAKE

Location:	Town of Klamath Falls, Klamath County
Size:	98,560 acres
Depth:	40 feet (max.) 8 feet (mean)

Problem and Source: This lake is characterized as highly eutrophic with heavy blooms of blue-green algae. No single source of nutrients can be found. The natural drainage systems provide the major nutrient source with a minor contribution from agricultural runoff.

Rehabilitation: All possible corrective means of controlling the nuisance algal blooms have been considered and were discarded because of costs and other imposed dangers. The control of nutrients from entering the lake is one means that may be possible.

Background Data: A wealth of data exist on the lake, past and present. The Federal Water Quality Administration, Pacific Northwest Water Laboratory is continuing eutrophication studies. Oregon State University has also conducted extensive studies on the lake.

PENNSYLVANIA

BLACK MOSHANNON LAKE

Location: Centre County; Black Moshannon State Park
Size: 250 acres
Depth: 20 feet (max.) 5 feet (mean)

Problem and Source: The lake suffers from dense and widespread rooted aquatic plants; yellow and white water lilies, water shield, milfoil, bladderwort, and several pondweeds (Potomogeton natans, P. noduesus, P. epihydrus).

Sources of the nutrients causing the problem are: 1) 40 cottages with septic tanks or outhouses and, 2) seepage from park latrines.

Rehabilitation: Aquatic herbicides applied annually give partial control.

Background Data: Limited background data is available from the Pennsylvania Department of Forests and Waters, Bureau of Parks in Harrisburg.

CONEWAGO LAKE

Location: York County; Giffort Pinchot State Park
Size: 340 acres
Depth: 25 feet (max.) 8 feet (mean)

Problem and Source: The lake supports a dense growth of unicellular algae and rooted aquatic plants; pondweeds (Potomogeton crispus, P. notous), waterweed (Elodea), coontail, chara, and najas.

Sources of nutrients include: 1) septic tank seepage, 2) agricultural runoff.

Rehabilitation: Annual control has been practiced with aquatic herbicides.

Background Data: Same as Black Moshannon Lake.

LAKE CONNEAUT

Location: Crawford
Size: 928 acres
Depth: 65 feet (max.)   34 feet (mean)

Problem and Source: Submerged rooted aquatic weed growths along shore areas interfere with boating, swimming and other uses.

Domestic waste sources entering the lake are thought to cause the problem.

Rehabilitation: Some local chemical treatment programs have been attempted. More long range solutions have been undertaken recently, for example, phosphorus removal is required of discharges in the lake's watershed, and lakeshore homes have been connected to a collection and treatment system.

Background Data: Background data include scientific surveys based on limited sampling and analysis. It is available through the Pennsylvania Department of Health, Division of Water Quality.

EDINBORO LAKE

Location: Erie County
Size: 247 acres
Depth: 30 feet (max.)   13 feet (mean)

Problem and Source: Problems in the lake include excessive algal and weed growth plus siltation in the upper end. Contributors to the problem are largely domestic and agricultural waste sources.

Rehabilitation: Applications of copper sulfate and Diquat have been made with little success. Collection and exportation of sewage outside the lake drainage area is suggested.

Background Data: Background data include scientific surveys based on limited sampling and analysis. It is available through the Pennsylvania Department of Health, Division of Water Quality.

Comments: The lake is used for boating, skiing, swimming, fishing, and summer residences.

FRANCES SLOCUM LAKE

Location: Luzerne County; Frances Slocum State Park
Size: 165 acres
Depth: 30 feet (max.) 6 feet (mean)

Problem and Source: The primary problem in this lake is a dense growth of rooted aquatic plants; water smartweed (Polygonum amphilium) and coontail.

Sources of nutrients contributing to the problem are 1) seepage from septic tanks, 2) agricultural runoff, 3) urban runoff.

Rehabilitation: Annual control with aquatic herbicides is practiced.

Background Data: See description for Black Moshannon Lake.

GOULDSBORO LAKE

Location: Monroe and Wayne Counties; Gouldsboro State Park
Size: 255 acres
Depth: 30 feet (max.) 12 feet (mean)

Problem and Source: Problems in this lake center around dense growths of rooted aquatic plants: water lilies, watershield, tape grass, pondweeds, milfoil, and bladderwort. Sources of nutrients contributing to the problem include, 1) seepage from septic tanks, and 2) industrial wastes.

Rehabilitation: Partial control is planned with application of aquatic herbicides.

Background Data: See description for the Black Moshannon Lake.

LAKE HARVEY

Location:	Luzerne County
Size:	658 acres
Depth:	102 feet (max.) 50 feet (mean)

Problem and Source:	The lake has an extremely low concentration of dissolved oxygen in the hypolimnion which resulted in a kill of lake trout. In addition, high coliform bacterial counts have been recorded. Domestic waste sources drain directly into the lake.
Rehabilitation:	Collection and exportation of sewage outside the lake's drainage area is suggested.
Background Data:	See description for Conneaut Lake.

HILLS CREEK LAKE

Location:	Tioga County; Hills Creek State Park
Size:	137 acres
Depth:	20 feet (max.) 8 feet (mean)

Problem and Source:	The lake has a dense growth of unicellular algae and rooted aquatic plants; pondweed (Potomogeton crispus), waterweed (Elodea) and najas. Sources of nutrients contributing to the problem include: 1) seepage from septic tanks, 2) agricultural runoff, 3) park facilities (privies), and 4) urban runoff.
Rehabilitation:	Annual control with aquatic herbicides is practiced.
Background Data:	See description for Black Moshannon Lake.

LAKE JEAN

Location: Luzerne and Sullivan Counties
Size: 254 acres
Depth: 25 feet (max.)   10 feet (mean)

Problem and Source: This lake suffers from dense growths of rooted aquatic plants; yellow and white water lilies, milfoil, and bladderwort. Sources of nutrients include: 1) seepage from septic tanks and privies, and 2) industrial wastes.

Rehabilitation: Partial annual control is practiced with aquatic herbicides.

Background Data: See description for Black Moshannon Lake.

LAKE MARBURG

Location: York County; Codorus Creek State Park
Size: 1,275 acres
Depth:

Problem and Source: The lake supports a dense growth of rooted aquatic plants along its entire shoreline (26 miles) out to a depth of 12 feet. Species include: waterweed (*Elodea*) and pondweed (*Potomogeton crispus*).

Rehabilitation: Partial annual control with aquatic herbicides has been tried.

Background Data: See description for Black Moshannon Lake.

PROMISED LAND LAKES

Location: Pike County; Promised Land State Park
Size: 595 acres
Depth: 20 feet (max.)   7 feet (mean)

Problem and Source: The lake supports a dense growth of rooted aquatic plants; yellow and white water lilies, watershield, bladderwort, and pondweeds.

Sources of nutrients to the lake include:

seepage from septic tanks and privies.

Rehabilitation: Partial control with aquatic herbicides is done annually.

Background Data: See description for Black Moshannon Lake.

PYMATUNING RESERVOIR

Location: Crawford County; Pymatuning State Park
Size: 16,420 acres
Depth: 35 feet (max.) 8 feet (average)

Problem and Source: The lake supports a dense growth of milfoil. Sources of nutrients to the lake include: 1) seepage from septic tanks and privies, and 2) industrial, urban, and agricultural runoff.

Rehabilitation: Partial annual control will be attempted by application of aquatic herbicides.

Background Data: See description for Black Moshannon Lake.

SHENANGO RESERVOIR

Location: Mercer County
Size: 3,560 acres
Depth:

Problem and Source: This is a recently constructed multi-purpose reservoir, with bottom drawoff devoid of dissolved oxygen with generation of hydrogen sulfide and iron staining. The area flooded for the reservoir was in part sewage and marshland.

Rehabilitation: Attempts have been made to get multi-level outlet control, but this is impractical because the dam is already built. One recommendation would be low pressure aeration in the vicinity of the dam to aerate and turn over the water.

Background Data:	See description for Conneaut Lake.
Comments:	A waterworks located downstream of the dam is experiencing taste and odor problems.

TOBYHANNA LAKE

Location:	Monroe and Wayne Counties; Tobyhanna State Park	
Size:	170 acres	
Depth:	25 feet (max.)	7 feet (mean)

Problem and Source:	The lake supports a dense growth of rooted aquatic plants: yellow and white water lilies, milfoil, watershield and bladderwort. Sources of nutrients include septic tank and privie seepage.
Rehabilitation:	Annual control with aquatic herbicides is practiced.
Background Data:	See description for Black Moshannon Lake.

SOUTH DAKOTA

LAKE ANDES

Location: Charles Mix County
Size: 4,600 acres
Depth: 16 feet (max.)

Problem and Source: Proposed plan would use the lake as a storage reservoir for irrigation water, using Missouri River water for replenishment. Advocates of this plan feel this would "flush" the lake and keep the quality near that of the Oahe Reservoir.

Background Data: Some background data is available on the lake.

BIG STONE LAKE

Location: Roberts County
Size: 21,120 acres
Depth: 15 feet (max.) 10 feet (mean)

See Minnesota for further data.

LAKE BYRON

Location: Beadle County
Size: 1,300 acres
Depth: 10 feet (max.) 8 feet (mean)

Background Data: Limited data is available on the lake.

Comments: The lake will be used as a storage reservoir for irrigation purposes.

LAKE HENDRICKS

Location: Brookings County
Size: 1,600 acres
Depth: 10 feet (max.) 5 feet (mean)

Problem and Source: The water quality in this lake has deteriorated tremendously since a "small watershed" project was completed. Diversion of water through the lake is apparently the cause.

Background Data: Not very much data is available, but public sentiment is becoming apparent.

LAKE HERMAN

Location: Lake County
Size: 1,350 acres
Depth: 8 feet (max.) 4 feet (mean)

LAKE MADISON

Location: Lake County
Size: 3,000 acres
Depth: 17 feet (max.) 8 feet (mean)

Problem and Source: Two federally funded projects are currently using these connecting lakes for study.

Background Data: Data is still fairly limited on these lakes.

LAKE KAMPESKA

Location: Codington County
Size: 3,000 acres
Depth: 18 feet (max.) 12 feet (mean)

Problem and Source: The lake is surrounded by extensive housing developments. Human wastes, animal wastes, and soil sediments are involved in the problem.

Rehabilitation: The lake is receiving some attention, but essentially no corrective treatments are being conducted.

LAKE MITCHELL

Location:	Davison County	
Size:	670 acres	
Depth:	29 feet (max.)	15 feet (mean)

Problem and Source:	This is an artificial lake furnishing the water supply for the city of Mitchell. Cabin developments without public sewerage have contributed to deterioration of the lake. The runoff area is also furnishing nutrients.
Background Data:	Some background data is available.

LAKE POINSETT

Location:	Hamlin County	
Size:	8,000 acres	
Depth:	18 feet (max.)	6 feet (mean)

Problem and Source:	The lake is deteriorating rapidly. Diversion of water from the Big Sioux River extenuates the problems involved. The drainage basin is nearly all cultivated with many livestock enterprises. Cabin developments around the lake have septic tank sewage systems.
Background Data:	More data is available on this lake than any other lake in the state.

TWIN LAKE

Location:	Spink County	
Size:	1,500 acres	
Depth:	17 feet (max.)	6 feet (mean)

Problem and Source:	This lake has received little attention but is deteriorating rapidly. It is located in an agricultural area which is the source of nutrients to the lake.

TEXAS

No specific lakes in Texas are included in this survey, but some general background information on water quality in Texas lakes was provided by E. Gus Fruh, Associate Professor of Civil Engineering, at the University of Texas.

There are no natural lakes in Texas. Therefore, the following statements refer only to reservoirs.

1) Because south Texas impoundments deeper than 40 feet become stratified much earlier than northern lakes, all such reservoirs have oxygen depleted hypolimnions by at least the end of August. However, fishing is not affected since warm-water types of fish inhabit our streams and reside in the epilimnion.

2) Because hydroelectric power releases are generally located at the lower section of a dam, the oxygen depleted hypolimnetic waters are released and sometimes as a density current cause water quality problems downstream. However, often there is no dissolved oxygen problem because of the turbulence and spraying within the release water channel. In east Texas the iron and manganese released downstream can sometimes cause problems with water supplies.

3) One of the major problems is the rate of increase of taste and odor in water supplies. Actinomycetes have been strongly implicated.

4) Nutrient enrichment is a significant problem. However, there are some river systems in which productivity is low and in these cases both nitrogen and phosphorus are limiting. In impoundments receiving waste-water laden rivers, productivity is high although nitrogen is limiting by mid-summer. Iron availability (not concentration) sometimes limits algal growth in winter. In no case have other trace inorganic or organic nutrients been found limiting. The release of the nutrient rich hypolimnetic waters through power penstocks alleviates the eutrophication problem in most reservoirs.

5) The influent and effluent from power plants generally break the stratification of the shallower reservoirs thereby recycling nutrients throughout the impoundment. Such reservoirs, originally built only as cooling ponds, are now the best fishing areas in Texas. No thermal pollution exists in summer because of the type of fish present and in winter the heated effluent aids fish growth. The effect of a heated discharge in a reservoir which remains thermally stratified is not known.

6) A major water quality problem is dissolved solids concentration. Sealing of salt cavities and springs is being conducted by the U. S. Army Corps of Engineers. In the future, selective withdrawal will probably be used to control the dissolved solids in the water released from reservoirs.

7) With reference to specific rehabilitation projects, there are some reservoirs whose uses are considerably impaired as a result of deteriorating water quality. However, at this time there are not sufficient data available to document a change if rehabilitation were undertaken.

UTAH

BEAR LAKE

Location:	Rich County and Bear County
Size:	70,400 acres
Depth:	208 feet (max.) 100 feet (average)

Problem and Source:	This clear oligotrophic lake is showing signs of accelerated enrichment. Sources of increased nutrient additions include cattle yards, domestic effluents from local municipalities and an ever increasing summer home population, and possibly runoff from crop lands. Although by many standards this lake appears to be in excellent condition, there are unmistakable signs of pollution. Because of a peculiar water supply, water removal regimen, these conditions could be magnified many times during unusually dry years.
Rehabilitation:	Zoning to control location and intensity of land use for cattle yards, and regulation of domestic wastes to prevent excessive nutrient additions are recommended. Possible limitation on type and timing of application of fertilizers may also be necessary.
Background Data:	Several publications and theses are available from the Department of Wildlife Resources, Utah State University, Logan, Utah. These include references to fish and to nutrient, dissolved oxygen, and bacterial levels.

GREAT SALT LAKE

Location:	Box Elder, Tooele, Salt Lake, Davis and Weber Counties
Size:	640,000 acres
Depth:	30 feet (max.)

Problem and Source: Information pertaining to the oxygen, nitrate, phosphate content of waters, so important to the management of fresh water lakes, becomes meaningless when applied to the dense, highly saline brines of Great Salt Lake. But Great Salt Lake is involved in problems, some of which are recognized whereas others are only suspected. Lack of research funds has precluded the detailing of items.

However, the lake represents a sump into which wastes generated by man since the occupation of this valley eventually find their way. One specific problem is that of bacterial contamination. Until 20 years ago communities bordering the lake dumped their raw sewage into the brines. Some such sewage is thought to be still present. Today these communities treat their sewage and discharge waters to the the lake that have received secondary treatment, yet the bacterial count remains essentially as it was 20 years ago. With increased population pressure the bacterial count can be expected to increase. Other problems involving mineralogy, chemistry, migration of brines - and their ancillary effects on ecology - are under some stage of investigation.

Rehabilitation: All problem aspects of the lake require the infusion of research funds. This applies to the lake's bacterial contamination as well as to other areas of investigation. But with respect to bacterial contamination and biochemical-oxygen demand it can be predicted that within the next few years tertiary treatment of all sewage discharges will be required.

Background Data: Background data on the lake include: publications of the Utah Geological and Mineralogical Survey pertaining to chemistry of the brines, migration of the brines, dissolved load, mineralogy of the bottom sediments, and meteorology related to the lake's surface; various theses from the University of Utah pertaining to the brines and their biota;

investigations of the University of Utah's Civil Engineering Department pertaining to bacteria and the stratification of fresh waters overlying the brines; open-file data of Utah's State Department of Health; Guidebooks of the Utah Geological Society; and equipment of the Utah Geological & Mineralogical Survey including two research vessels and laboratory facilities.

HYRUM RESERVOIR

Location: Cache County
Size: 500 acres
Depth: 65 feet (max.)   26 feet (average)

Problem and Source: The reservoir was created by the construction of a dam on the Little Bear River near Hyrum, Utah in 1935. The primary purpose of the reservoir was storage capacity for agricultural use. Since approximately 1960, the recreational use of the reservoir has increased to the extent that it was incorporated into the State Park system in 1965. Swimming, water skiing, boating, and fishing activities have continued to increase significantly each successive year. In mid-summer of 1969 a massive bloom of Aphanizomenon occurred, resulting in a serious curtailment of recreational activity. A similar bloom occurred in the late summer of 1970.

Rehabilitation: Zoning to control location and intensity of land uses associated with barnyards, dairy, cattle grazing and municipal dumps is recommended. Also, tributary to the reservoir and contributing nutrients are a trout farm, irrigation return flows and municipal sewage discharges. These sources should also be curtailed.

Background Data: A publication by the Utah Fish and Game Department is currently available (January, 1971). Two separate investigations are in progress by Utah State University, one through the Center for Water Resources Research and one sponsored by a Federal Water Quality Administration training grant in the Department of Civil Engineering. Both studies are evaluating nutrient inputs and budgets, as well as algal growth rate kinetics.

UTAH LAKE

Location: Utah County
Size: 94,720 acres
Depth: 20 feet (max.) 8 feet (average)

Problem and Source: This is a shallow, wind agitated mesotrophic lake which has undergone marked changes toward a eutrophic state in the past 100 years.

Upwards of 6 endemic species and subspecies of fish and molluscs have become extinct. Another 35 species of native fishes and molluscs have been extripated. The dominant littoral vegetation is an introduced species, Tamarix pentandra which is a notorious phreatophyte.

Recently localized algal blooms of blue-green algae and desmids have extended across the lake during the summer when a calm of three or more days occurs.

The area surrounding Utah Lake has increased in human population faster than any in Utah County. Sewage plants adequate 10 years ago are overwhelmed by present loads and only a few communities are making attempts to improve and enlarge them.

Homes have encroached on the river banks and the incoming streams channeled and diverted. Most of the water during late spring through fall is low quality irrigational, urban and industrial return flow.

Many farmers use the river banks and lake edge as a fence to retain livestock and feed lots are increasing. Aerial photography shows that 90% of the cattle are pastured with unlimited access to incoming streams.

Truck farming is giving way to corn, and farmers are being urged to increase yield through increased fertilizer application.

Three of the four main solid waste disposal areas are located in areas of high water table and low surface water which drains into the lake.

The present plans call for diking 1/3 of the lake to reduce evaporation, but little has been done to clean up the incoming waters. Projected changes in water quality by various agencies have not considered PO_4 or NO_3 and NH_4 in their calculations. We have calculated a nominal budget of 900,000 pounds input and 100,000 pounds output of phosphates, and the diking would not decrease the input but confine its biogeochemical cycling and sedimentation to 2/3 of the present lake basin. In addition, the major source of water would become the Spanish Fork River and it is three times as high as other incoming water in total dissolved solids and colloidal clays.

No study has been done on the effect of diking on the benthos of Utah Lake. The areas proposed for drying may be the most productive and important in recycling and fixing nutrients.

Rehabilitation:

1) A multidiscipline Lake Authority to develop a workable set of objectives and development and enforcement of urban, industrial and agricultural zoning ordinances should be created.

2) A study of the rate of phosphate sedimentation, recycling and plankton uptake.

3) Education and poling of people living about and using the lake so that what it becomes is their decision.

4) A quality long-term study of the effect of diking on the benthos.

Background Data:

At least two publications are available on Utah Lake. One involves the changes in biota in the lake and the other the water chemistry and pesticide residue levels of the lake. Both are available through the Utah Lake Research Station, Brigham Young University.

VERMONT

LAKE CHAMPLAIN

Location: An international water bordering Vermont, New York State, and the Province of Quebec.
Size: 273,280 acres
Depth: 400 feet (max.)

Problem and Source: Lake Champlain originated with the North American Great Lakes, is also in the St. Lawrence drainage basin, and has limnological characteristics similar to the Great Lakes. Because of Pleistocene biogeography, the fauna of the lake is essentially the same as in the Great Lakes.

The main portion of Lake Champlain is in a mesotrophic condition, but the conditions have deteriorated in the last ten years. Certain isolated portions of the lake, though of major economic value, have become eutrophic. Most of the many bays along the periphery of the lake now have algae problems, contaminated water, and fish kills. A pulp and paper mill at the southern end of the lake, where the width is narrow, has been depositing wastes since 1890. *Cladophora* has been making itself known along the shores for the first time; and for the first time in history, bathing beaches on both the Vermont and the New York sides of the lake have been closed because of excessive coliform counts. During the summer of 1970, all fishing was banned in the lake (Vermont side, and Commercial fishing in Canada) because of excessive amounts of mercury in the fish. High mercury concentrations have now been found in the zooplankton. The citizens on both sides of the lake, and Canada, are demanding action.

Rehabilitation: Previous corrective measures: In 1904 the Governor of Vermont requested the Federal Government to investigate the pollution of the lake from the paper industry on the

New York side of the lake. The Federal Government made a survey, but nothing happened. The same thing took place in 1966-67, and the Federal Government made a survey, but this time had a hearing, and the allegations were confirmed. Though legal negotiations are still going on, the situation has been forced into one of improvement.
The State of Vermont has been following an active program of construction of sewage treatment facilities within the drainage basin. It is only now that genuine efforts are being made by the local governments and the citizens to return Lake Champlain to a more desirable condition.

Proposed corrective measures: At the federal hearings in 1967, it was decided that the large sludge beds in the south end of the lake, deposited in part by a pulp and paper mill, be removed. The Company is building a completely new plant, with a modern waste treatment facility. This new plant is to go into limited operation on December 1, 1970. Scientists at the University of Vermont, and the State Government plan to monitor the area for at least a year before and after the plant goes into operation.

Other remedial action would be to get the numerous villages, on both sides of the lake, to obtain sewage treatment plants. Also, the larger villages should look into nutrient removal from the sewage. Since about 20 major tributaries inflow to the lake, progress could be well measured, because the entire drainage basin is divisible into well-defined basins. Since the "refill" rate is only 2.6 years, corrective actions in the drainage basin should be noticed in a reasonably short time.

Background Data: A great deal of background information is available.

1) About two dozen U.S.G.S. gaging stations are located in the Champlain watershed, and the ten largest tributaries to the lake are measured for stream discharge. About 64% of the entire drainage basin is monitored on a daily basis for water discharge. Therefore, there is a good measure of how much water is flowing into the lake.

2) The discharge of Lake Champlain has been measured for several decades.

3) Lake levels have been measured for three locations on the lake. The oldest lake level data goes back about 90 years. There is the need for some lake level data in the southern portion of the lake. The probability (or frequency) of daily lake levels has been computed and graphed.

4) The Champlain basin has one first-class U. S. weather station in Burlington, Vermont, near the center of the lake. No less than 36 cooperative U. S. Weather Bureau weather stations are also found in the drainage basin.

5) Extensive limnological data have been collected on the lake by scientists at the University of Vermont since 1964. Extensive surveys have been made of the lake on a synoptic basis since 1965. A survey of portions of the lake in 1928, and a federal survey of the lake in 1903 would allow for a measure of the changes of the characteristics of the lake in time.

The Lake Champlain Studies Center, University of Vermont, has been collecting data on the lake for the past five years with the hope that the data would serve to document past conditions, and also indicate where problems exist, and in general help to manage the return of the lake to an oligotrophic condition. In this sense, the Lake Center offers an arm to the State Government in bringing this about.

LAKE DUNMORE

Location: Addison County; town of Salisbury
Size: 1,035 acres
Depth: unknown

Problem and Source: The problem is rapid eutrophication caused mainly by septic tank seepage from cottages.

Background Data: Little background data is available.

Comments: Lake use is primarily recreational (contact and noncontact) and as a drinking water supply. The lake is ringed with cottages; the owners of which have formed the Lake Dunmore Association to try to deal with the problem.

LAKE MEMPHREMEGOG

Location: Northern Vermont (Orleans County) and Southern Quebec
Size: 24,237 acres (6,317 in Vermont)
Depth:

Problem and Source: This was a deep and oligotrophic lake, known for salmon and lake trout. The town of Newport, Vermont, located at the southern end of the lake has been the main contributor of nutrients.

Rehabilitation: Studies have been made by the Canadians and Vermont officials for the past years on the matter, and Newport now has a new sewage treatment plant that should help to improve the lake.

VIRGINIA

CHARLOTTESVILLE RESERVOIR

Location: Central Virginia
Size: 103 acres
Depth: 15 feet (average)

Problem and Source: A large input of algal nutrients has created an undesirable situation. Eutrophication is accelerated in the reservoir as indicated by periodic algal blooms, frequent fish kills, occasional obnoxious tastes and odors in the finished product of the water treatment plant, and the establishment of benthic invertebrates tolerant to organic pollution. Although the problem is not critical at this time, such conditions as those in the Occoquan will, in all probability soon exist unless steps are taken to limit the algal nutrient input to the reservoir.

Background Data: The staff has evaluated most of the sources of nutrients and is now awaiting the opportunity to gather much needed data during a period of storm water runoff.

Comments: The lake is the water supply for the city of Charlottesville.

CHICKAHOMINY LAKE

Location: 35 miles east of Richmond (near Providence Forge)
Size: 1,500 acres (approx.)
Depth: 10 feet (average)

Problem and Source: Chickahominy Lake is also eutrophic. Several years ago, the State Water Control Board staff conducted an extensive study in this area and found that eutrophication was caused by natural conditions and discharges from domestic waste treatment facilities.

Rehabilitation:	In order to reduce the degree of the problem, the State Water Control Board established very strict standards for any future discharges and required the County of Henrico and the city of Richmond to eliminate all discharges to the watershed or institute the necessary treatment to eliminate nitrogen, phosphorus and carbon from the discharges. Since this policy was instituted by the State Water Control Board, the County of Henrico has had an active program of eliminating the discharges by abandoning their treatment plants and connecting to the city of Richmond's sewerage facilities which discharge to the James River Basin.
Comments:	The lake serves as part of the water supply for Newport News. Because of the nutrients from natural sources, the lake is extremely productive in terms of biological organisms; and for this reason, is used extensively by fishermen and hunters.

OCCOQUAN RESERVOIR

Location:	Northern Virginia (near Woodbridge)
Size:	1,600 acres (approx.)
Depth:	
Problem and Source:	The problem is this reservoir is accelerated eutrophication brought about by the addition of algal nutrients primarily from treated domestic waste water discharges in the watershed.
Rehabilitation:	Corrective treatments have, in the past, been focused on the elimination of tastes and odors in the finished water at the water treatment plant through chemical treatment and the application of algacides in the reservoir itself as well as improvements in waste treatment facilities within the watershed. These

corrective measures have proven to be totally inadequate with the result that problems with tastes and odors have become more intense.

Background Data: During 1968 and 1969, the State Water Control Board acquired the services of Dr. Claire Sawyer, Metcalf and Eddy, Inc. of Boston, Mass. Under the direction of Dr. Sawyer the staff conducted a comprehensive study of the entire Occoquan watershed with particular emphasis placed on the algal nutrient input to the reservoir, its quantity and sources.

Dr. Sawyer has presented a detailed report of his findings to the Board with the recommendation that all waste waters be exported from the watershed. Dr. Sawyer's recommendation and those of others have been "aired" at public hearings and are now before the Board for consideration.

Comments: The lake serves as a water supply for approximately 450,000 people in Fairfax and Prince William Counties and the city of Alexandria.

POUNDS RESERVOIR

Location: Southwestern Virginia (near Pounds)
Size: 154 acres
Depth:

Problem and Source: Degradation of this impoundment is of a toxic nature, i.e., acid mine drainage. Strip mines on the headwaters of the North Fork of the Pound River have exposed materials which oxidize to form inorganic acids, lowering the pH of the drainage and thereby drastically depressing the biological productivity of the watershed.

Rehabilitation: It would appear that the only possible method of eliminating this problem would be a land reclamation program in the mined areas.

The State Water Control Board has requested that the staff conduct a public hearing at Pound as the first step in the pollution abatement process.

Comments: Serves as a water supply for approximately 1,000 people.

SMITH MOUNTAIN RESERVOIR

Location: 5 miles south of metropolitan Roanoke
Size:
Depth:

Problem and Source: The Roanoke Arm of this lake suffers primarily from organic degradation and accelerated eutrophication with the great majority of the organics and algal nutrients being supplied by treated waste discharges and untreated storm water overflows from the metropolitan Roanoke area. Numerous fish kills have been observed on this Arm and are attributed to this enrichment.

Background Data: The staff of the State Water Control Board has completed a preliminary investigation of the Roanoke River Watershed, and a technical report is being prepared for review by the Board.

Comments: This lake serves as a pump-storage, hydroelectric generating facility. The Roanoke and Blackwater Rivers are the two primary tributaries of the lake. The Roanoke River sub-basin contains a sewage-industrial complex whereas the Blackwater River watershed contains essentially forests and farms.

WASHINGTON

AMERICAN LAKE

Location: 8 miles south of Tacoma
Size: 1,125 acres
Depth: 90 feet (max.)

Problem and Source: Nuisance algal blooms occur in the lake.

Rehabilitation: Herbicide treatment has been on a regular basis.

Background Data: A commercial biologist has charge of algal control. Nature of background data is unsure.

BADGER LAKE

Location: 8 miles south of Cheney
Size: 244 acres
Depth: 105 feet (max.)

Problem and Source: Lake is in middle to late mesotrophy and suffers from blue-green algal growths in August and September (primarily *Lyngbya sp.* and *Anabaena sp.*).

Rehabilitation: No treatment is reported to date.

Background Data: Occasional sampling has been done for algae counts and nutrient analysis.

Comments: The lake is heavily used for recreational purposes. It drains indirectly into Williams Lake.

BAY LAKE

Location:
Size: 129 acres
Depth: 11 feet (max.)

Problem and Source: The lake is eutrophic to the point of causing fish mortalities during bloom periods. Nutrient sources are thought to be primarily natural including duck excrement.

Rehabilitation: No treatment has been tried.

Background Data: Nature of background data is uncertain.

CRANBERRY LAKE

Location: 1 1/2 miles southwest of Anacortes
Size: 27 acres
Depth: 20 feet (max.)

PASS LAKE

Location: 6 miles south of Anacortes
Size: 99 acres
Depth: 20 feet (max.)

CAMPBELL LAKE

Location: 5 miles south of Anacortes
Size: 410 acres
Depth: 22 feet (max.)

Problem and Source: These three lakes (above) are eutrophic. They experience blooms of algae to the point that the water turns green and mats form. Surrounding homes are few or non-existent. Concentrated sources of nutrients are not apparent so the cause is thought to be natural.

Background Data: Some background data exist on these lakes but of a limited nature. Collection was by students at Skagit Valley College, Mt. Vernon, Washington.

GREEN LAKE

Location: Seattle
Size: 255 acres
Depth: 24 feet (max.)

Problem and Source:	This is a naturally eutrophic lake with large blooms of nuisance blue-green algae.
Rehabilitation:	Low-nutrient city water was added on a continuous basis in 1962 at a rate that displaces the lake's volume annually. This technique has resulted in increased water clarity, reduced nutrient levels, decreased algal biomass and occurence of nuisance blue-green algae has now been restricted to only part of the growing season.
Background Data:	Data is available in: Oglesby, R. T., Effect of controlled nutrient dilution on the eutrophication of a lake, in "Eutrophication, Causes, Consequences, and Correctives," National Academy of Science, 1969.

ISLAND LAKE

Location:	
Size:	109 acres
Depth:	31 feet (max.)

Problem and Source:	Nuisance algal blooms and clodea have developed in the littoral zone in recent years. Septic tank drainage into the lake from surrounding homes is probably the source of the problem.
Background Data:	No background data has been collected on the lake.

LONG LAKE

Location:	3 1/2 miles southeast of Pt. Orchard, Washington
Size:	314 acres
Depth:	shallow, exact depth uncertain

Problem and Source:	The lake is in an advanced state of eutrophy, with dense blooms of blue-green algae. This is probably a natural condition since concentrated sources are not apparent.

Rehabilitation: No corrective treatments have been tried.

Background Data: No background data has been collected on the lake.

LONG LAKE

Location: 23 miles northwest of Spokane
Size: 5,020 acres
Depth:

Problem and Source: The lake receives partially treated sewage and industrial wastes from Spokane City area.

Background Data: This lake has been studied somewhat by the Washington Water Pollution Control Commission.

Comments: The lake serves as a power reservoir on the Spokane River.

MEDICAL LAKE

Location: Medical Lake City
Size: 149 acres
Depth: 60 feet (max.)

Problem and Source: The lake is highly eutrophic and experiences large blooms of Anacystis Anabaena Flos-aquae. The problem is probably due to the large organic loading received by the lake.

Rehabilitation: No treatment is reported for the lake.

Background Data: The lake has been sampled occasionally.

MOSES LAKE

Location: Moses Lake
Size: 6,815 acres
Depth: 38 feet (max.)

Problem and Source: This is an historically eutrophic lake.

Blue-green algae form mats on the surface throughout the summer, washing ashore to create unpleasant conditions of considerable magnitude.

Rehabilitation: Addition of lower-nutrient Columbia River water to dilute nutrients has been proposed, but not carried out because of objections of irrigators downstream from the lake. Flushing is still considered to have merit with the addition of surface skimmers to prevent algae from moving back to flushed out areas by wind driven surface currents.

Background Data: Two and one-half years of extensive data on nitrogen, phosphorus, chlorophyll, seston, particulate carbon, community composition, secchi disk depths and oxygen and temperature profiles exists with which to compare post-treatment changes. In addition, extensive in situ experiments to determine the causitive factors in the dilution water effects or algal growth and species succession are available.

NEWMAN LAKE

Location: 16 miles northeast of Spokane
Size: 1,190 acres
Depth: 30 feet (max.)

Problem and Source: The lake experiences excessive growth of blue-green algae in the late summer and also aquatic weed growth is a problem due to the shallow depth of the lake.

Rehabilitation: No treatment has been reported for this lake.

Background Data: The lake has been sampled occasionally.

PINE LAKE

Location: 4 miles north of Issaquah
Size: 88 acres
Depth: 39 feet (max.)

Problem and Source: This lake is highly eutrophic probably as a result of septic tank drainage from surrounding houses.

Rehabilitation: No treatments have been tried.

Background Data: Only scanty background data exists for the lake.

ROCK LAKE

Location: 32 miles south of Spokane
Size: 2,147 acres
Depth: 320 feet (max.)

Problem and Source: Silt from runoff entering the lake reduces productivity to that of an oligotrophic lake until mid-July when the water clears and persistent blue-green algae occur; usually Aphanizomenon.

Rehabilitation: No previous or proposed treatment was reported for this lake.

Background Data: Algae counts and nutrient levels are monitored regularly by the Washington State University, Sanitary Engineering Research Group. Analysis is done by Standard Methods and neutron activation. Data has been collected for three years.

LAKE SAMMAMISH

Location: 10 miles east of Seattle
Size: 4,997 acres
Depth: 100 feet (max.)

Problem and Source: An increased state of cultural eutrophication (comparable to Lake Washinton in 1964-65), exists in this lake.

Rehabilitation: Diversion of a major nutrient source, Issaquah sewage effluent and milk plant wastes, was accomplished in 1968. (estimated 50%

phosphorus and 80% nitrogen previously entering lake.). By 1970, recovery was apparent and reflected in increased water clarity, decreased algal biomass, and increased hypolimnetic oxygen content.

Background Data: Data is available in: Edmondson, W. T., Eutrophication in North America, in "Eutrophication, Causes, Consequences and Correctives," National Academy of Science, 1969.

SPANAWAY LAKE

Location: 10 miles south of Tacoma
Size: 267 acres
Depth: 28 feet (max.)

Problem and Source: Nuisance algal blooms and swimmers itch are the main problems in the lake.

Rehabilitation: Herbicide treatment has been tried.

Background Data: Commercial biologist has charge of algal control. Extent of background data available is not known.

STEILACOOM LAKE

Location: 3 miles east of Steilacoom
Size: 313 acres
Depth: 23 feet (max.)

Problem and Source: Nuisance algal blooms are a problem in the lake.

Rehabilitation: Herbicide treatment is done on a regular basis.

Background Data: A commercial biologist has charge of algal control. The extent of background data available on the lake is not known.

VANCOUVER LAKE

Location: 3 miles northwest of Vancouver, Washington
Size: 2,858 acres
Depth: shallow, on flood plain of Columbia River

Problem and Source: The lake is under study by Washington State University, Pullman, Department of Civil Engineering.

LAKE WASHINGTON

Location: Seattle, Washington
Size: 21,650 acres
Depth: 100 feet (mean)

Problem and Source: An advancing state of cultural eutrophication was noted in the lake until the mid-1960's due to additions of sewage effluents from the city of Seattle.

Rehabilitation: Formation of the Metro (Municipality of Metropolitan Seattle) which developed an effective sewage-disposal system and implemented it between 1963-68 has diverted all treatment plant effluents from the lake. This has resulted in noticeable improvements in water quality; increased transparency and decreased nutrient levels.

Background Data: Extensive background data is available. See: Edmondson, W. T.. Water Quality Management and Lake Eutrophication: The Lake Washington Case, in Water Resources Management and Public Policy, edited by Thomas H. Campbell and Robert O. Sylvester (Seattle: U of W Press, 1968) for documentation of sources.

WHATCOM LAKE

Location: 3 miles east of Bellingham
Size: 5,003 acres
Depth: 311 feet (max.)

Problem and Source: A history of cultural eutrophication in the west end of the lake is believed to be caused largely by septic tank drainage from surrounding homes.

Rehabilitation: Attempts at control have been in the form of sewering developments around the lake.

Background Data: The problem has been studied intensively by Western Washington State College workers, so adequate background data probably exist to document a change in the lake.

WILLIAMS LAKE

Location: 11 miles southwest of Cheney
Size: 319 acres
Depth: 115 feet (max.)

Problem and Source: This lake is in late mesotrophy and experiences intermittent blue-green algae blooms from late July and August through mid-September. The primary species involved are Anabaena Flos-aquae, Lynbya, and Aphanizomenon Flos-aquae.

Rehabilitation: Some remedial treatments have been tried.

Background Data: Extensive data collection has been going on for three years, nutrients and algal count have been monitored by Washington State University, Sanitary Engineering Research Group.

Comments: The lake is heavily used for recreation.

WISCONSIN

BIG BUTTERNUT LAKE

Location: Polk County
Size: 378 acres
Depth: 19 feet (max.)

Problem and Source: Excessive weeds and algae are the primary problem in this lake. Sources of nutrients are surface runoff, ground water, and possibly domestic sewage from private disposal systems.

Rehabilitation: Previous chemical control of weeds has been practiced.

Background Data: The Department of Natural Resources has data pertaining to general chemistry and fisheries.

BIG MUSKEGO LAKE

Location: Waukesha County, Town of Muskego
Size: 2,260 acres
Depth: 23 feet (max.) 3 feet (mean)

Problem and Source: Problems in this lake include deteriorating water quality, unstable lake levels, winter-kill which inhibits the fishery, undesirable fish species, frequent algal "blooms," and lack of water recreational space due to shallow depths.

Rehabilitation: Some weed cutting is done. Incorporation of upstream sewered area with the Milwaukee Metropolitan Sewer System is needed. Some dredging is also proposed.

Background Data: Data are available through Wisconsin Department of Natural Resources, Big Muskego Lake, Lake Use Report No. FX-3.

BROWNS LAKE

Location: Racine County, Town of Burlington
Size: 396 acres
Depth: 44 feet (max.)   8 feet (mean)

Problem and Source: Problems in this lake include deteriorating water quality, excessive weed growth and fluctuating water levels. (Fertility (Spring PO_4) high; nuisance hazard (Cl) medium).

Rehabilitation: Public sewerage is needed.

Background Data: Data are available through Wisconsin Department of Natural Resources, Browns Lake, Lake Use Report No. FX-15.

LAKE BUTTE DES MORTS

(See Wolf River Lakes)

BUTTERNUT LAKE

Location: Price County
Size: 830 acres
Depth: 23 feet

Problem and Source: Sources of nutrients are surface runoff, ground water and runoff from the village of Butternut.

Rehabilitation: No information is given.

Background Data: No information is given.

LAKE DELAVAN

Location: Walworth County
Size: 2,072 acres
Depth: 56 feet (max.)

Problem and Source:	Problems in the lake include high coliform counts and weed and algal growths. Sources of nutrients include Jackson Creek, surface runoff, ground water, and possibly private sewage disposal systems.
Rehabilitation:	Installation of a sanitary sewer system is needed. Also elimination of upstream nutrient sources; e.g., Elkhorn sewage treatment plant effluent which enters Jackson Creek. Previous treatment includes weekly marginal $CuSO_4$ (cutrine) treatments for algae. Chelated $CuSO_4$ has been used recently. Rough fish removal has also been practiced.
Background Data:	General limnological studies and recommendations have been completed by Limnetics Inc., Milwaukee, Wisconsin. Department of Natural Resources has data on nutrients, transparency, plankton, general chemistry, temperature profiles, and fisheries.

EAGLE LAKE

Location: Racine County, Town of Dover
Size: 520 acres
Depth: 15 feet (max.) 7 feet (mean)

Problem and Source:	The lake suffers from deteriorating water quality, winterkill, fluctuating water levels, and excessive algal and weed growths (fertility (Spring PO_4) medium, nuisance hazard (Cl) high). There are point sources of pollution contributing to the problem.
Rehabilitation:	Adequate sewage treatment in the drainage basin is needed. Some dredging to improve fishery and eliminate weed growths would also be desirable.
Background Data:	Data are available through the Wisconsin Department of Natural Resources, Lake Use Report No. FX-19.

HALFMOON LAKE

Location: Eau Claire County
Size: 132 acres
Depth: 9 feet (max.)

Problem and Source: The lake has excessive algae growths and a rough fish problem. Source of nutrients is surface runoff.

Rehabilitation: Chemical control and rough fish removal has been practiced previously.

Background Data: The Department of Natural Resources has data on the general chemistry and fisheries.

HORSESHOE LAKE

Location: Manitowoc County
Size: 22 acres
Depth: 54 feet (max.)

Problem and Source: Planktonic algae and some rooted aquatics are a problem in this lake. The sources of nutrients are poorly defined; individual septic systems may contribute, also a former cheese factory may have contributed to the problem.

Rehabilitation: Horseshoe Lake was treated in Spring, 1970, with alum for phosphate precipitation by the Inland Lake Demonstration Project (U.W. Extension and Department of Natural Resources).

Background Data: The lake was sampled and analyses done for 11 months in 1966 by the State Lab of Hygiene (chemical and some biological data). It has been monitored monthly since February 1970, by the Inland Lake Renewal Project.

LAKE KOSHKONONG

Location: Jefferson County
Size: 10,480 acres
Depth: 6 feet (max.)

Problem and Source: Problems in this lake include shallow depths, algal blooms, winter-kill, poor quality fishery and reduced recreational values.

Rehabilitation: In the past rough fish control has been practiced along with occasional attempts at algae and weed control, and continual efforts to reduce fertilization. Dredging of parts of the basin is recommended.

Background Data: Department of Natural Resources reports on the lake and fishery and lake map, the USGS Rock River Basin Report and other data constitute sufficient background information to document change.

LILLY LAKE

Location: Kenosha County, Town of Wheatland
Size: 87 acres
Depth: 25 feet (max.) 9 feet (mean)

Problem and Source: Lake problems include winterkill, fluctuating water level and aquatic weeds (fertility (Spring PO_4) low, nuisance hazard (Cl) low).

Rehabilitation: Mechanical weed cutting for control of vegetation has been done for several years. Dredging to prevent winterkill is proposed.

Background Data: Data are available through Wisconsin Department of Natural Resources, Lake Use Report No. FX-34.

LITTLE MUSKEGO LAKE

Location: Southeastern Waukesha County
Size: 506 acres
Depth: 65 feet (max.) 14 feet (mean)

Problem and Source: The lake suffers from excessive weed and algal growths and general deterioration in water quality; fertility (Spring PO_4) medium; nuisance hazard (Cl) high.

Rehabilitation: Measures to control aquatic vegetation are taken each summer.

Installation of sanitary sewers and bypass of the lake with storm sewer system are proposed as well as continued harvesting and land disposal of rooted aquatics.

LONG LAKE

Location: Polk County
Size: 257 acres
Depth: 10 feet (max.)

Problem and Source: Excessive weeds and algae are a problem in this lake. Sources of nutrients are surface runoff and ground water.

Rehabilitation: Chemical control of weeds and algae has been practiced in the past.

Background Data: The Department of Natural Resources has data on general chemistry and fisheries.

LONG LAKE

Location: Racine County, Towns of Burlington and Rochester
Size: 124 acres
Depth: 5 feet (max.) 3 feet (mean)

Problem and Source:	Problems in this lake include winterkill, excessive weed growth, fluctuating water levels, and general deterioration of water quality, (fertility (Spring PO_4) high, nuisance hazard (Cl) high.
Rehabilitation:	Relocation of a barnyard and some cottages on the shoreline are necessary. Dredging to prevent winterkill would also be desirable.

LOWER PHANTOM LAKE

Location:	Waukesha County, town of Mukwonagon
Size:	433 acres
Depth:	12 feet (max.) 4 feet (mean)

Problem and Source:	Problems noted in this lake include excessive algal and weed growth, and general deterioration of water quality, (fertility (Spring PO_4) medium; nuisance hazard (Cl) low.
Rehabilitation:	Application of chemicals, dredging, and recently, mechanical harvesting of aquatic vegetation have been tried with marginal success.
Background Data:	Data are available through the Wisconsin Department of Natural Resources, Lake Use Report No. FX-14.

MADISON LAKES

LAKE MENDOTA

Location:	Dane County
Size:	9,730 acres
Depth:	82 feet

LAKE MONONA

Location:	Dane County
Size:	3,335 acres
Depth:	64 feet

LAKE WAUBESA

Location:	Dane County
Size:	2,113 acres
Depth:	34 feet

LAKE KEGONSA

Location:	Dane County
Size:	2,716 acres
Depth:	31 feet

Problem and Source: All four of the lakes presently have excessive growths of algae and aquatic vegetation. Severe algal blooms on Mendota and Monona were recorded as early as 1882; odor was a major problem for many years. Construction of sewage treatment facilities and the diversion of treatment plant effluents has lessened the problems, but the lakes are still eutrophic. Aphanizomenon, Microcystis, and Anabaena are the primary problem-causing algae.

Sources of nutrients: At the present time, effluents from domestic treatment plants are diverted around the lakes except for a few small communities north of Lake Mendota at the upper end of the chain. Both rural and urban runoff contribute significant nutrient inputs.

The nutrient inputs to Lake Mendota have been studied in considerable detail. Estimates of the nitrogen and phosphorus influx from the various sources in the basin have been prepared by Lee et al, 1969. In general, the major portion of the phosphorus originates from point sources, whereas diffuse sources account for most of the nitrogen input.

Lake Monona also receives the heated discharge from the Madison Gas and Electric Company.

Rehabilitation: Nutrient diversion and chemical treatment for algal control have been the primary rehabilitation practices. In recent years the mechanical harvesting of aquatic weeds has been employed.

Background Data: Extensive background data exists for the lakes, especially for Lake Mendota. Much basic limnological data was collected by Birge and Juday. Sawyer conducted major studies of the sources of nutrients to the lakes, particularly Monona, Waubesa and Kegonsa. Rohlich and Lee examined the origin and quantity of nutrient input to Lake Mendota and Lawton described the lakes before and after diversion. Bottom sediments have been studied by many investigators. In addition, many theses, papers, and reports describing the lakes have been prepared.

LAKE METONGA

Location: Forest County
Size: 2,157 acres
Depth: 74 feet (max.)

Problem and Source: Eutrophication of this lake is increasing due to inadequate soils for individual sanitary systems. Indicators of the conditions are high fertility and algae.

Background Data: There has been a request for a survey by the local lake association. No water quality data are on file.

LAKE NAGAWICKA

Location: Waukesha County
Size: 957 acres
Depth: 90 feet (max.)

Problem and Source: Some coliform counts, very heavy algal and weed growths, are probably caused by increasing urban population.

Rehabilitation: A sanitary sewer system is needed, in addition to elimination of upstream rural and urban nutrient sources.

Background Data:	A University of Wisconsin student group has made water quality investigations. Poor soils in the area, and an upstream sewage treatment plant contribute nutrients.

PELL LAKE

Location: Walworth County, Town of Bloomfield
Size: 86 acres
Depth: 13 feet (max.) 9 feet (mean)

Problem and Source:	Among the problems in this lake are winterkill, fluctuating water levels, and general deteriorating water quality, (fertility (Spring PO_4) medium; nuisance hazard (Cl) medium).
Rehabilitation:	Sodium arsenite was applied to beach areas from 1954-58 for weed control. Lake rehabilitation through controlled use of toxicants is proposed; also permanent installations for aeration are suggested, as well as dredging.
Background Data:	Data are available through the Wisconsin Department of Natural Resources, Lake Use Report No. FX-37.

PEWAUKEE LAKE

Location: Waukesha County, Towns of Delafield and Pewaukee
Size: 2,493 acres
Depth: 45 feet (max.) 15 feet (mean)

Problem and Source:	The lake suffers from excessive algal and weed growth and a general deterioration of water quality, (fertility (Spring PO_4) high, nuisance hazard (Cl) medium. Sources of nutrients include surface runoff, groundwater, and possibly private sewage disposal systems.

Rehabilitation: The lake has a history of intensive chemical and mechanical weed control, two harvesters are commonly in operation on the lake. Both sodium arsenite and copper sulfate have been used in the past for control of rooted aquatics and algae respectively. An aquatic plant control program should be coordinated for the future.

Background Data: Data are available through the Wisconsin Department of Natural Resources, Lake Use Report No. FX-2.

PICKEREL LAKE

Location: Portage County
Size: 52 acres
Depth: 12 feet

Problem and Source: Problems in this lake include excessive algae and swimmers' itch. Sources of nutrients are surface runoff and ground water.

Rehabilitation: Chemical control of algae and swimmers' itch have been tried previously.

LAKE POYGON

(See Wolf River Lakes)

LAKE REDSTONE

Location: Sauk County
Size: 625 acres
Depth: 40 feet (max.)

Problem and Source: Excessive algal and aquatic weed growth result from high nutrient levels in water. Nutrient enrichment may originate from septic tank absorption fields in adjacent development and/or from agricultural runoff.

Rehabilitation:	Chemical treatment for weed control by the Department of Natural Resources has been applied in the past.
Background Data:	Some data are available from the Department of Natural Resources (1968 and 1970) including nutrient levels, temperature, dissolved oxygen, alkalinity, and conductance.
Comments:	This is an artificial lake, built in 1964-65.

ROUND LAKE

Location:	Burnett County
Size:	203 acres
Depth:	24 feet

Problem and Source:	Excessive algae is the main concern in this lake. Sources of nutrients are surface runoff, ground-water, and possibly private disposal systems.
Rehabilitation:	Chemical control of algae has been undertaken in the past.
Background Data:	The Department of Natural Resources has data on general chemistry and fisheries.

SHAWANO LAKE

Location:	Shawano County (northeastern)
Size:	6,178 acres
Depth:	42 feet (max.)

Problem and Source:	Shawano Lake, even in its natural state, would most likely be considered eutrophic. The nature of its shallow basin and extensive littoral zone promote conditions suitable for the growth of emergent and submergent aquatic plants. The lake is fed primarily by ground waters, containing significant amounts of nitrate which encourage the eutrophic condition

Rehabilitation: Two problems that Shawano Lake now faces are plankton blooms and growths of macrophytes. The two methods tried in the past to relieve these conditions are application of chemical toxicants and mechanical control. These methods are relatively inexpensive but they have provided only temporary relief.

Cultural eutrophication has undoubtedly had a significant effect on Shawano Lake. The construction of a sanitary sewer should eventually slow this type of eutrophication, but will not cure the problems.

Two methods of permanent control, dredging and a controlled nutrient budget are recommended for Shawano Lake problems. These methods are extensive and expensive operations and should not be considered without detailed investigation.

Background Data: Backup material regarding problems of Shawano Lake may be obtained from the Northeastern Wisconsin Regional Planning Commission files. No water quality data is on file.

Comments: Recreational use of Shawano Lake is intense and rehabilitation is desirable.

SNAKE LAKE

Location: Vilas-Oneida counties
Size: 12 acres
Depth: 22 feet (max.)

Problem and Source: The foremost problems in Snake Lake have been frequent fishkills, excessive rooted and planktonic aquatics, and high nutrient levels.

The lake received effluent from the town of Woodruff sewage treatment plant from 1941 to 1958, when a subsoil effluent disposal system was installed. The plant was shut down entirely in 1964. Storm sewer runoff also enters lake.

Rehabilitation: Snake Lake has been undergoing extensive restoration activities since 1968 by the Inland Lake Renewal and Management Demonstration Project (U. W. Extension and the Department of Natural Resources). The lake was pumped down in the fall, 1969, and again in summer, 1970, to test the effect on nutrient levels of dilution due to increased ground water inflow after pumping. More extensive coverage of this project is available in "Snake Lake Report; Inland Lake Renewal Project."

Background Data: First chemical analyses were done by Juday in 1928; extensive sampling and analysis were carried out from 1942-48; isolated samples were analysed in 1952, and 1967. The lake has been continuously monitored by the Inland Lake Project from March, 1969 to date.

TICHIGAN LAKE

Location: Racine County, Town of Waterford
Size: 891 acres
Depth: 63 feet (max.) 15 feet (mean)

Problem and Source: The lake is experiencing a deterioration in water quality due to improperly functioning soil absorption sewage treatment systems and additions of untreated or inadequately treated sewage to the Fox River at Waukesha during storm flows. Excessive algal and weed growths occur in the lake as a result, (fertility (Spring PO_4) high; nuisance hazard(Cl) high).

Rehabilitation: Public sewerage is needed.

Background Data: Data are available through the Wisconsin Department of Natural Resources, Lake Use Report No. FX-6.

WHITE POTATO LAKE

Location: Oconto County
Size: 975 acres
Depth: 15 feet (max.)

Problem and Source: This lake experiences winterkill and excessive aquatic weed growth.

Rehabilitation: Dredging of portions of the basin is recommended.

Background Data: Fish surveys and a lake map constitute the background data which is sufficient for a partial evaluation of improvements.

WIND LAKE

Location: Racine County, Town of Norway
Size: 936 acres
Depth: 47 feet (max.) 10 feet (mean)

Problem and Source: Problems in this lake include deteriorating water quality and drifting plant matter which creates shore use problems (fertility (Spring PO_4) high; nuisance hazard (Cl) high).

Rehabilitation: No steps have been taken to date. Development of a sanitary district for the town of Norway is proposed.

Background Data: Data are available through the Wisconsin Department of Natural Resources, Lake Use Report No. FX-5.

LAKE WINNEBAGO

Location: Winnebago, Calumet, and Fond Du Lac Counties
Size: 137,708 acres
Depth: 21 feet (max.)

Problem and Source: Lake Winnebago with its tremendous area compared to its shallow depth is a naturally eutrophic lake. This condition is compounded by the inflow of nutrient enriched streams, agricultural runoff, and industrial and municipal wastes which contribute to severe algae growths.

Rehabilitation:	Corrective measures such as a controlled nutrient budget would be a challenge with Winnebago's 6,000 square miles of drainage. With problems becoming worse, rehabilitation is a must, not only from the aesthetic viewpoint but Lake Winnebago is also an increasing source of municipal water supply.
Background Data:	Winnebago is continuously monitored by the Department of Natural Resources. No water quality data is on file with the Northeastern Wisconsin Regional Planning Commission.

LAKE WINNECONNE

(See Wolf River Lakes)

WOLF RIVER LAKES

LAKE POYGAN

Location:	Winnebago County (central)
Size:	14,102 acres
Depth:	11 feet (max.)

LAKE WINNECONNE

Location:	Winnebago County (central)
Size:	4,507 acres
Depth:	10 feet (max.)

LAKE BUTTE DES MORTS

Location:	Winnebago County (central)
Size:	8,857 acres
Depth:	11 feet (max.)
Problem and Source:	The same problems that face Lake Winnebago (see above) also face this chain of lakes, but these lakes have the additional problem

of bog loss during high water. When the bog is broken up the trapped nutrients are released adding to the lakes already enriched state.

Background Data: Lake Poygan is monitored continuously by the Department of Natural Resources.

WYOMING

A general statement concerning the quality of Wyoming lakes was supplied by Arthur E. Williamson, Director of Sanitary Engineering Services for the Wyoming Department of Health and Social Services.

1) Wyoming lakes are not suffering from water quality degradation (Williamson). This fortunate circumstance is probably attributable to the following two conditions.

    a) Practically all of Wyoming's natural lakes lie at very high elevations and in the National Forest areas. Therefore, the period of use is limited and they are above pollution sources.

    b) All of the large reservoirs at lower elevations are primarily for irrigation purposes; therefore, water is continually moved through these structures, preventing any cycling effect of wastes. All sources of waste are receiving adequate treatment, which helps in maintaining these reservoirs in excellent condition.

2) One large lake and several small ones in the state have been formed by return irrigation flows and are expected to develop problems with increasing solids and overfertilization.

APPENDICES

INFORMATION SOURCES

ARKANSAS

S. Keith Jackson, Director
Arkansas Soil and Water Conservation
Commission
State Capitol
Little Rock, Arkansas 72201

Chicot, Lake

CALIFORNIA

Jerome B. Gilbert, Executive Officer
State Water Resources Control Board
Room 1140, Resources Building
1416 Ninth Street
Sacramento, California 95814

Berryessa, Lake
Clear Lake
Goose Lake
Salton Sea

Arthur F. Pillsbury, Director
Water Resources Center
University of California
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Los Angeles, California 95814

COLORADO

Frank J. Rozich, Technical Secretary
Water Pollution Control Commission
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Granby Reservoir
Grand Lake
Shadow Mountain Reservoir

John C. Ward, Associate Professor
Civil Engineering Department
Foothills Campus
Sanitary Engineering Program
Colorado State University
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Cheraw Lake

CONNECTICUT

John J. Curry, Director
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

- Bantam Lake
- Crescent Lake
- Groton Pond
- Hitchcock Lakes
- Kenosia, Lake
- Lillinoah, Lake
- Wonoscopomuc, Lake
- Zoar, Lake

DELAWARE

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- All Lakes

FLORIDA

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- Alice, Lake
- Apopka, Lake
- Bivens Arm
- Clear Lake
- Dora, Lake
- Eustis, Lake
- Griffen, Lake
- Harris, Lake
- Hawthorn Lake
- Lochloosa, Lake
- Newnan's Lake
- Orange Lake
- Wauberg, Lake

FLORIDA *CON'T*

Richard M. Duchrow Charles Starling Fishery Biologists *Florida Game and Freshwater Fish Commission* *Fisheries Research Laboratory* *P. O. Box 1088* *Eustis, Florida 32726*	Alligator, Lake Beauclair, Lake Carlton, Lake Catherine, Lake Conine, Lake Dexter, Lake Dicie, Lake Effie, Lake Francis, Lake Hancock, Lake Hollingsworth, Lake Inglis Reservoir Jessie, Lake Killarney, Lake Lawne, Lake Lulu, Lake Maggiore, Lake Maitland, Lake McLeod, Lake Munson, Lake Okeechobee, Lake Parker, Lake Rodman Reservoir Rowell, Lake Scott, Lake Seminole, Lake Shipp, Lake South, Lake Talquin, Lake Thonotosassa, Lake Tohopekaliga, Lake Tracy, Lake Tsala Apopka, Lake Underhill, Lake Virginia, Lake Wales, Lake

GEORGIA

R. S. Howard, Jr., Executive Secretary *Georgia State Water Quality Control Board* *47 Trinity Avenue, S.W.* *Atlanta, Georgia 30334*	Jackson, Lake

Dr. A. W. Hoadley *Sanitary Engineering Department* *Georgia Institute of Technology* *Atlanta, Georgia 30332*	High Falls Lake

ILLINOIS

C. W. Klassen, Director *Environmental Protection Agency* *Springfield, Illinois 62706*	Fox Chain of Lakes

INDIANA

Oral H. Hert, Director *Division of Water Pollution Control* *State Board of Health* *1330 West Michigan Street* *Indianapolis, Indiana 46206*	All Lakes

KANSAS

John C. Ward, Associate Professor *Civil Engineering Department* *Foothills Campus* *Sanitary Engineering Program* *Colorado State University* *Fort Collins, Colorado 80521*	Cheney Reservoir

LOUISIANA

Elvin J. Dantin, Director *Water Resources Research Institute* *Louisiana State University* *Division of Engineering Research* *Baton Rouge, Louisiana 70803*	Caddo Lake Calcasieu Lake Catahoula Lake Cocodrie Lake Cross Lake Fausse Point, Lake Ponchartrain, Lake Sabine Lake Salvadore, Lake Six Mile Lake Verret, Lake

MAINE

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Maine Department of Inland Fish and Game
State House
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Charles Boothby, Executive Director
Soil and Water Conservation Commission
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Robert E. Foye, Assistant Chief
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Auburn Hall
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Bangor, Maine 04401

Matthew Scott, Aquatic Biologist
Maine Environmental Improvement Commission
State House
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Annabessacook Lake
Bauneg Beg Lake
Bonny Eagle Lake
Cobbosseecontee, Lake
Cochnewagon Pond
Estes Lake
Little Ossippe Lake
Lovejoy Pond
Middle Range Pond
North Pond
Pattee Pond
Pushaw Lake
Sabattus Pond
Schoodic Lake
Sebasticook Lake
Spaulding Pond
Taylor Pond
Three Mile Pond
Togus Pond
Toothacker Pond
Webber Pond

MARYLAND

David A. Wharton
Warm Water Fisheries Biologist
Maryland Fish and Wildlife Administration
State Office Building
Annapolis, Maryland 21401

Roland, Lake

MASSACHUSETTS

"Report of the Department of Health, Relative to an Investigation and Study of the Removal of Aquatic Weeds and Other Growths from Certain Lakes and Streams in the Commonwealth and Other Related Matters."
House Report #4888, December 3, 1969.

Cochituate, Lake
Flint Pond
Jordan Pond
Reservoir Pond
Sherman, Lake
Stiles Pond
Studley Pond
Watson Pond

Massachusetts Division of Fisheries and Game

Bartlett Pond
Hager Pond
Lower Mystic Lake
Upper Mystic Lake

George J. Coogan, Director
Bureau of Water Supply and Water Quality
Division of Environmental Health
Massachusetts Department of Public Health
600 Washington Street
Boston, Massachusetts 02111

Ashfield Lake
Ashmere, Lake
Billington Sea
Buel, Lake
Flax Pond
Forest Lake
Nutting Lake
Pontoosuc Lake
Quinsigamond, Lake
Sabbatia, Lake
South Watuppa Pond

MICHIGAN

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Michigan State University
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Mona Lake
Odessa, Lake
Pigeon River Lakes

MICHIGAN *CON'T*

Carlos Fetterolf, Supervisor
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Stevens T. Mason Building
Lansing, Michigan 48926

- Barton Lake
- Bear Lake
- Betsie Lake
- Brighton Lake
- Chemung Lake
- Deer Lake
- First Lake
- Ford Lake
- Fremont Lake
- Jordan Lake
- Kent Lake
- Lansing, Lake
- Lobdell Lake
- Macatawa Lake
- Manistee Lake
- Mona Lake
- Muskegon Lake
- Ore Lake
- Randall Lake
- Sixth Lakes
- White Lake

MINNESOTA

Gene Hollenstein, Chief Hydrologist
Division of Water, Soils, and
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Minnesota Department of Conservation
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- Big Stone Lake
- Briggs Lake
- Buffalo Lake
- Cotton Lake
- Demontroville Lake
- Detroit Lake
- Francis Lake
- Jefferson Lake
- Julia Lake
- Long Lake (Isanti)
- Long Lake (St. Louis)
- Madison Lake
- Melissa, Lake
- Minnetonka Lake
- Pike Lake
- Prior Lake
- Rice Lake
- Rush Lake
- Sakatah Lake
- Sallie, Lake
- Shagawa Lake
- Shetek Lake
- Spring Lake
- Tetonka Lake

MINNESOTA *CON'T*

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Amber Lake
Budd Lake
George Lake
Hall Lake
Sisseton Lake

MISSOURI

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Jacomo, Lake

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Georgetown Lake

NEBRASKA

G. L. Hergenrader, Ph.D.
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Branched Oak Reservoir
Pawnee Reservoir
Stagecoach Reservoir

NEW HAMPSHIRE

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Kezar Lake
Winnisquam Lake

NEW JERSEY

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NEW YORK

Ray T. Oglesby, Associate Professor *Aquatic Science* *Department of Conservation* *New York State College of Agriculture* *Cornell University (Fernow Hall)* *Ithaca, New York 14850*	Cayuga Lake Conesus Lake Oneida Lake Owasco Lake Seneca Lake
Kenton M. Stewart, Assistant Professor *Department of Biology* *State University of New York at Buffalo* *Health Sciences Building* *Buffalo, New York 14214*	Onondaga Lake
Shigeru Kobayashi *for* N. Clesceri *Department of Environmental Engineering* *Rensselaer Polytechnic Institute* *Troy, New York 12181*	George, Lake Saratoga Lake Schroon Lake

NORTH DAKOTA

John J. Peterka, Assistant Professor *Department of Zoology* *North Dakota State University* *Fargo, North Dakota 58102*	Ashtabula, Lake Jamestown Reservoir Spiritwood Lake

OHIO

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OKLAHOMA

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Carl Blackwell, Lake
Grand Lake

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Foss Reservoir

OREGON

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Devils Lake
Odell Lake
Upper Klamath Lake

PENNSYLVANIA

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Black Moshannon Lake
Conewago Lake
Conneaut, Lake
Edinboro Lake
Frances Slocum Lake
Gouldsboro Lake
Harvey, Lake
Hills Creek Lake
Jean, Lake
Marburg, Lake
Promised Land Lakes
Pymatuning Reservoir
Shenango Reservoir
Tobyhanna Lake

SOUTH DAKOTA

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Andes, Lake
Big Stone Lake
Byron, Lake
Hendricks, Lake
Herman, Lake
Kampeska, Lake
Madison, Lake

SOUTH DAKOTA *CON'T*

John L. Wiersma *Con't*	Mitchell, Lake Poinsett, Lake Twin Lake

UTAH

College of Engineering *Utah State University* *Logan, Utah 84321*	W. F. Sigler W. P. Hewitt N. B. Jones	Bear Lake Great Salt Lake Hyrum Reservoir Utah Lake

VERMONT

E. B. Henson *Marsh Life Science Building* *University of Vermont* *Burlington, Vermont 05401*	Champlain, Lake Dunmore, Lake Memphremegog, Lake

VIRGINIA

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American Lake
Bay Lake
Campbell Lake
Cranberry Lake
Green Lake
Island Lake
Long Lake (Kitsap)
Long Lake (Spokane)
Moses Lake
Pass Lake
Pine Lake
Sammamish, Lake
Spanaway Lake
Steilacoom Lake
Vancouver Lake
Washington, Lake
Whatcom Lake

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Browns Lake
Delavan, Lake
Eagle Lake
Halfmoon Lake
Madison Lakes
Nagawicka, Lake
Pewaukee Lake
Pickerel Lake
Round Lake
Tichigan, Lake

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Big Muskego Lake
Browns Lake
Delavan, Lake
Eagle Lake
Lilly Lake
Little Muskego Lake
Long Lake (Racine)
Lower Phantom Lake
Nagawicka, Lake
Pell Lake
Pewaukee Lake
Tichigan, Lake
Wind Lake

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Big Butternut Lake
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Delavan, Lake
Halfmoon Lake
Long Lake (Polk)
Pewaukee Lake
Pickerel Lake
Round Lake

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16. Abstract

A survey of 452 eutrophic lakes was compiled based on responses from 40 states requesting information as to a) Name, location, size, depth; b) Description of the problem, including accounts of previous corrective treatments, if any; c) Remedial action that might be appropriate; d) A description of available background data, indicating whether sufficient data exists to document a change if rehabilitation were undertaken. The study comprises 240 lakes which are larger than 100 surface acres, 44 in the 51-100 acre size, and 68 smaller than 50 surface acres. The compilation represents lakes which have, in view of the respondents, deteriorated to the extent that rehabilitation is desirable. Categories of the problems in the survey were: nuisance algal growth, nuisance aquatic vegetation, fishkills, bacterial contamination, toxic contamination, oil brines, unstable water levels, siltation, excessive dissolved solids, and unspecified eutrophic conditions. Sources contributing to these problems were classified in two general categories--concentrated sources and diffused sources. Indication is given, where available, whether progress has been made to eliminate the pollution source or whether the source has already been eliminated. (Auen-Wisconsin)

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